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Un sommaire en français de ce rapport est inclus avant la table des matières.

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16. Abstract

The objective of this project has been to investigate the circumstances in which oil spills occur from tankers at sea by analyzing available historical oil spill data.

The shipborne technologies that the ship could use to control and recover the spill were identified and evaluated based on their practicality and effectiveness under various accident scenarios.

The recommended system is based on three components:

1. A policy initiative to have the tanker owner/operator demonstrate the capability to lighter a specified volume of oil.
2. This capability must also include a specified capacity of onboard storage for internal oil transfer.
3. An emergency response plan including system training.

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16. Résumé

Ce projet a pour objet de déterminer les circonstances entourant les déversements accidentels d'hydrocarbures en milieu marin, d'après les cas survenus dans le passé.

Le rapport recense les dispositifs dont pourraient être équipés les navires pour maîtriser les déversements et récupérer les hydrocarbures déversés. Les dispositifs sont évalués en fonction de leur facilité de mise en oeuvre et de leur efficacité en diverses circonstances.

La solution retenue comporte trois volets:

1. Capacité d'allègement en mer, à être démontrée par les propriétaires ou les armateurs.
2. Capacité de transfert interne d'une partie de la cargaison.
3. Élaboration d'un plan d'intervention en cas d'accident, prévoyant notamment une formation du personnel navigant.

17. Mots clés

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U.S. Minerals Management Service

PREFACE

The marine transportation of oil by tanker imposes an inherent environmental risk. If a spill can be controlled or limited by an immediate response system available on the tanker, marine environmental damage and economic cost may be significantly reduced.

This paper presents:

1. An investigation of the circumstances in which oil spills occur from tankers at sea;

2. The identification of shipborne technology which the tanker could use to control and recover the spill; and

3. Development and evaluation of the effectiveness of some self-help systems using various criteria including practicality of operations.

It must be emphasized that this study reviewed equipment and procedures that might supplement those currently aboard tankers to provide immediate response to, and/or control of, an oil spill. The mandate of this study did not include review of tanker design features that might prevent oil spills nor did it consider means and methods, provided external to the tanker, to respond to an oil spill. This study also did not review operating procedures or navigational aids that might be utilized to prevent the accident creating the oil spill in the first instance. The study focussed upon the shipborne technology that might be placed aboard a tanker, perhaps temporarily, to respond to an oil spill.

EXECUTIVE SUMMARY

The Transportation Development Centre of Transport Canada contracted Monenco Consultants Limited to research tanker self-help spill recovery systems.

A review of oil spill history on both a Canadian and a worldwide basis provided information on the characteristics surrounding marine oil spill accidents. A report obtained from the U.S. Department of Interior, Minerals Management Services, is a data base of marine oil spills greater than 134 tonnes which have occurred between 1974 and June, 1990.

A detailed analysis of this data base and others, highlighted the following points:

- marine oil spills of 5000 tonnes and greater account for 39.4% of the accidents yet 94.7% of the total spilled quantity;
- 84% of these spills (>5000 tonnes) occur in vessels 20 000 DWT and larger;
- 78.5% of spills over 5000 tonnes occur outside of harbour or pier areas, where spill response equipment may not be readily available; and
- over 50% of spills are caused by groundings and collisions where the vessel crew might potentially be able to respond in mitigating and controlling the outflow of oil.

Review of the historical marine oil spill data provided the following observations:

- Tanker self-help systems appear to warrant serious consideration since, in the majority of incidents, the tanker crew might possibly be in position to devote certain attention towards mitigation and/or controlling a spill assuming the priority of ship safety may not be an issue.

- A small number of incidents, relative to the total number of marine oil spill accidents, create a very high percentage of total oil spilled. As a result, the tanker self-help systems might focus initially upon the vessel sizes, types, etc., creating these large spills.

- A very high percentage of the incidents referenced above occur outside harbours in an area where oil spill clean-up equipment is presumably not available.

The report defines the requirements or specifications of a tanker self-help system which could address the aforementioned spill history. Although a tanker self-help system must satisfy many requirements, it is particularly important that the system be safe, easily operational, practical and effective for the variety of oils and operational conditions likely to be encountered in a marine oil spill.

The report describes potential tanker self-help systems ranging from additives such as bioremediation, dispersants and solidifiers to equipment such as portable pumps, booms and skimmers. The many "candidate" tanker self-help systems are reviewed in terms of their ability to satisfy the aforementioned system specifications. The candidate systems were then analyzed to assess their possible performance during the major marine oil spills that have occurred in Canadian waters.

As a result of these evaluations, four self-help systems are identified as potential candidates for further evaluation and possible implementation: they are:

- internal oil transfer;
- hydrostatic loading;
- external oil lightering; and
- contingency planning.

The report concludes with an evaluation of a system design and outlines its benefits and possible implementation based upon integration of the preferred attributes of the above four options.

Implementation recommendations include:

- Development of a regulatory policy requiring tanker owners/operators and the marine industry to demonstrate tanker self-help capability based on oil transfer, rather than development of one specific system, because of the various types of vessels and possible technical solutions available.
- Crew training, in support of a self-help initiative and as part of an emergency response plan.

SOMMAIRE

Le Centre de développement des transports de Transports Canada a chargé la société Monenco Consultants Limited d'effectuer une étude sur les équipements d'intervention d'urgence en cas de déversement d'hydrocarbures en mer pouvant être prévus à bord des navires.

Une étude des cas survenus en eaux canadiennes comme ailleurs dans le monde a permis de dégager certaines constantes dans les déversements accidentels d'hydrocarbures en milieu marin. Un rapport fourni par le U.S. Department of Interior, Minerals Management Services, a servi de base de données pour ce qui est des déversements de plus de 134 tonnes qui se sont produits entre 1974 et juin 1990. Ce rapport ainsi que d'autres sources d'information ont révélé ce qui suit :

- les déversements de 5000 tonnes et plus comptent pour 39,4 p. 100 seulement du nombre d'accidents, mais représentent 94,7 p. 100 de la quantité totale d'hydrocarbures déversés;
- 84 p. 100 des déversements de plus de 5000 tonnes sont le fait de pétroliers de la classe des 20 000 TPL ou d'une classe supérieure;
- 78,5 p. 100 des déversements de plus de 5000 tonnes se produisent au large, donc souvent loin de tout matériel d'intervention;
- plus de la moitié des déversements sont causés par un échouement ou un abordage, et l'équipage serait peut-être en mesure d'intervenir, du moins pour réduire ou arrêter le déversement.

Une analyse des rapports d'accidents survenus dans le passé a permis de tirer les conclusions suivantes :

- il semble opportun de considérer sérieusement l'équipement des pétroliers en matériel d'intervention d'urgence, étant donné que dans la majorité des cas de déversement accidentel, l'équipage serait peut-être capable d'intervenir pour réduire ou arrêter le déversement, dans la mesure où la sécurité du navire ne serait pas en jeu;
- un fort pourcentage de la quantité totale d'hydrocarbures déversés est attribuable à un faible pourcentage du nombre d'accidents survenus; il pourrait donc y avoir intérêt à étudier les dispositifs possibles d'intervention d'urgence en fonction d'abord des classes de pétroliers responsables des plus importants déversements;
- un très fort pourcentage des déversements importants se produisent au large, où en principe il ne se trouve aucun matériel d'intervention pour de telles situations.

Les chercheurs ont défini les caractéristiques que devrait posséder un dispositif d'intervention d'urgence en cas de déversement d'hydrocarbures en mer à partir des cas survenus dans le passé. Celui-ci devrait surtout être sûr, facile à mettre en oeuvre, commode et efficace pour tous types de produits pétroliers et toutes circonstances dans lesquelles un déversement peut se produire.

Le rapport décrit les diverses solutions possibles, depuis les produits tels qu'agents de dégradation bactérienne, émulsifiants et gélifiants jusqu'aux équipements tels que pompes, estacades et écrémeurs. Les dispositifs envisagés sont évalués par rapport aux spécifications préalablement définies, puis par rapport au rendement qu'ils auraient pu avoir dans les plus importants cas de déversements accidentels survenus en eaux canadiennes.

Quatre solutions ont été retenues en vue d'une évaluation plus poussée et d'une éventuelle mise en service, soit :

- capacité de transfert d'une partie de la cargaison à bord même du navire;

- «chargement hydrostatique»;

- capacité d'évacuation d'une partie de la cargaison;

- élaboration d'un plan d'intervention en cas d'urgence.

Enfin, le rapport propose un concept regroupant les caractéristiques les plus intéressantes des quatre solutions énumérées ci-dessus; il en présente les avantages et décrit les modalités possibles de mise en service.

Les recommandations concernant la mise en service comprennent notamment :

- adoption d'une réglementation obligeant l'industrie du transport maritime en général et les propriétaires et les armateurs de pétroliers en particulier à faire la preuve que leurs navires sont équipés du matériel nécessaire pour effectuer le transfert d'une partie de la cargaison en cas d'accident, plutôt que de mettre au point un dispositif en particulier, étant donné la diversité des navires et le grand nombre de solutions techniques possibles;

- formation du personnel navigant en fonction du dispositif d'intervention adopté, qui s'inscrirait dans le cadre d'un plan d'intervention d'urgence.

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1. INTRODUCTION

1.1 Background

The transport of oil through our oceans and inland waterways is a subject of increasing environmental concern. Recent oil spill occurrences, such as the EXXON VALDEZ, demonstrate the impact that a spill may have on the marine environment as well as the economic liability entailed.

The focus of oil spill response has traditionally been based on shore side capabilities. Historically, because of numerous uncontrollable parameters, only limited consideration has been given to the tanker response immediately after an accident occurs. It is at this time that the areal extent of a spill is relatively small, thus providing an opportunity for containment and recovery. The area of an oil spill increases considerably with time, making spill control very difficult. Research efforts into development of viable tanker self-help systems may identify opportunities to improve containment and recovery of oil spills, thus preventing unnecessary damage to the environment.

1.2 Project Objective

The overall modal objective of this project is to support the Canadian Coast Guard (CCG) in the development of regulations for the safe and efficient conduct of marine activities in waters under Canadian jurisdiction.

Another objective is to support the research and development of techniques and procedures for protecting the marine environment in furtherance of Transport Canada and Environment Canada objectives for prevention of pollution in waters of interest to Canada.

The specific project objective is to investigate the circumstances in which oil spills occur from tankers at sea, identify shipborne technology the vessel could use to control and recover the spill, and evaluate the effectiveness of such self-help systems under various historical accident scenarios and system constraints.

1.3 Scope of Work

The scope of work included the following key tasks:

1. Prepare spill history to identify circumstances surrounding spill scenarios.
2. Establish system constraints that have to be taken into account in developing tanker self-help concepts.
3. Develop system designs for tanker self-help spill containment and recovery.
4. Evaluate system designs with respect to equipment, procedures, cost, retro-fit, storage and technical feasibility.

5. Identify the legislation which might facilitate implementation of tanker self-help procedures for vessels in Canadian waters.

The scope of work reflects a mandate to focus upon equipment and procedures which constitute a system that can be contained on a ship and deployed in the event of an oil spill. This system (or systems) which might be identified as safe and practical to deploy should be available for use as soon after the spill event as is practically possible.

This scope of work therefore excludes a review of ship modifications such as double-hulls or other structural changes.

This scope of work includes all types of liquid hydrocarbon fluids.

2. METHODOLOGY

The approach utilized to aid in developing tanker self-help systems begins with a historical review of tanker oil spill data. This review includes information such as spill volume, vessel type and size, location, ship operational conditions, cause of accident and weather conditions. The focus of the review centres upon the characteristics of those accidents that contribute the highest amount of spilled oil volume. These accident types are then characterized, providing a basis for evaluating spill recovery systems.

The next step involves the identification of design parameters and constraints that apply to tanker oil spill scenarios. This includes factors such as:

- vessel type and size;
- vessel condition following event and the subsequent ability of the crew to respond to a spill;
- availability of shipboard utilities;
- equipment size and weight;
- facility of deployment;
- environmental conditions; and
- technology.

Information was gathered from technical references and sources familiar with tanker operations.

Taking into account the parameters and constraints previously mentioned, the initial tanker self-help spill recovery systems were developed. This included the technologies as well as the operational components that form a functional system. The systems were evaluated based on criteria developed from the historical oil spill scenarios previously determined and the preferred system(s) described.

Canadian and international legislation that might be utilized to facilitate the introduction of a tanker self help system will also be reviewed.

Sources of information accessed for marine oil spill history and system identification and evaluation, included regulators, tanker operators and equipment manufacturers worldwide.

The methodology is summarized in Figure 1.

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FIGURE 2.1
PROJECT METHODOLOGY

Objective	To identify tanker self-help spill recovery systems.
Problem Definition	Review of tanker spill history to identify circumstances and conditions that comprise a typical and atypical oil spill scenario.
Design Parameters and Specifications	Define constraints with respect to vessel type/size, human response capability, availability of shipboard power, equipment size and weight, facility of deployment and environmental conditions.
Develop Initial Concepts	Initial concept development to include equipment, procedures, safety, protocols and probability of use.
Concept Evaluation	Evaluate system concepts with respect to defined constraints including retro-fit, storage, costs and technical feasibility. Also evaluate with respect to actual historical Canadian spill event records.
Develop Operational Protocols	Identify the operational and legislative needs associated with the implementation of tanker self-help procedures for vessels in Canadian waters.
Preferred System (s)	Describe the preferred Tanker Self-Help System or Systems.

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3. SPILL HISTORY

3.1 Historical Marine Oil Spills

An examination of the equipment that might practicably be carried onboard an oil carrying vessel or barge requires a review of historical marine oil spill data to determine characteristic distributions of previous oil spills and any trends/tendencies that appear to be developing in recent years. In this way, the examination of self-help tanker equipment might concentrate upon a "threshold" level of spilled oil per accident or occurrence which provides a sufficiently small number of events and a sufficiently large quantity of spilled oil to justify the provision of equipment.

The review of historical spill data will also identify, to a certain extent, the tanker crew's ability to respond to an oil spill (relative to a greater priority of tanker safety and stability), location of accident, environmental conditions, amongst other factors. It is imperative therefore that a historical marine oil spill data base be obtained that provides sufficient details that a meaningful analysis of the data might be undertaken.

This study endeavoured to obtain historical marine oil spill statistics for Canadian waters as well as waters worldwide. This latter database was believed necessary in the event that the Canadian database proved too limited to provide a representative statistical sample, and also did not provide the accident information to allow the desired analysis of marine oil spills. For these reasons, a worldwide historical data base was deemed beneficial.

3.1.1 Data Limitations

The oil spill information presented in this report will provide a reasonable quantitative and qualitative description of circumstances surrounding tanker spills. However,there are certain limitations associated with information of this nature. The major limitations contributing to uncertainty include:

- not all spills are reported to authorities and are therefore not included in spill data bases;
- spills below a certain size, even if reported, may not be included in an available data base;
- circumstances surrounding spills may be reported based on subjective interpretation of what happened; and
- difficulty in determining actual spill volumes.

Consequently, the spill data presented must be viewed as a tool to provide basic oil spill information.

3.1.2 Canadian Marine Oil Spill Data Base

The Canadian historical marine oil spill data was accumulated, for the purpose of this report, from four principal sources:

- "Summary of Spill Events in Canada, 1974 - 1983", Environment Canada, November, 1987;
- "CCG Pollution Prevention Program Review", Melville Shipping Ltd., November, 1991;
- "Public Review Panel on Tanker Safety and Marine Spills Response Capability - Final Report", September, 1990; and
- Marine Occurrences Involving Major Pollution Derived from the Transportation Safety Board of Canada Data Base.

There undoubtedly are other sources of Canadian marine oil spill data but these four reports provided the information desired for the purposes of this report. [As described later in this chapter, the worldwide historical marine spill data base provided additional information concerning spills in Canadian waters.]

The report "Summary of Spill Events in Canada, 1973 - 1983" provided an analysis of all spills reported to Environment Canada and their computerized data base entitled NATES (National Analysis of Trends in Emergencies System) during this ten year period. The data base consists of all spills including land-based spills, and industrial, truck and watercraft spills. The spills include crude oil, oil products and certain non-oils such as chemicals, industrial waste and sewage. The report notes a total of 21 587 spill events during the 1974 - 1983 period resulting in 3 669 460 tonnes of spilled material. Of these spills, 1 029 spills or approximately 5% were created by waterborne craft. The material spilled by waterborne craft was identified to be 28 851 tonnes or 1% of the total spill during this period. The data for this period indicated that there were no significant trends in watercraft events or material spilled. The numbers remained reasonably consistent year to year.

This report also provided a distribution of watercraft spills by categories of "transfer accident", "collision, grounding and sinking" and "other". Table 3.1 provides this information. The salient points to be generated from this data include:

- the category "collision, grounding, and sinking" provided the smallest number of marine spill events but the largest quantity of materials spilled, an average spill of 116 tonnes per event; and
- the category "other", with the exception of a single year 1979, provides a spill quantity of 12.8 tonnes per event.

TABLE 3.1

Summary of Vessel Spill Events in Canada
Tankers, Bulk Carriers and Other Vessels
(1974-1983)

% of Total in Boldface

Year	Transfer Accident		Collision, Grounding, Sinking		Other		Total	
	Events	Tonnes	Events	Tonnes	Events	Tonnes	Events	Tonnes
1974	60	371	21	4 277	60	248	141	4 896
	43	**8**	**14**	**87**	**43**	**5**	**100**	**100**
1975	52	116	13	613	28	886	93	1 615
	56	**7**	**14**	**38**	**30**	**55**	**100**	**100**
1976	53	206	13	1 613	19	160	85	1 979
	62	**10**	**15**	**82**	**22**	**8**	**100**	**100**
1977	47	249	11	931	38	294	96	1 474
	49	**17**	**11**	**63**	**41**	**20**	**100**	**100**
1978	51	154	15	1 343	33	73	99	1 570
	52	**10**	**15**	**86**	**33**	**5**	**100**	**100**
1979	49	108	6	948	33	8 186	88	9 242
	56	**1**	**7**	**10**	**38**	**89**	**100**	**100**
1980	68	145	12	121	68	213	148	479
	46	**30**	**8**	**25**	**46**	**44**	**100**	**100**
1981	75	97	13	2 296	33	931	121	3 324
	62	**3**	**11**	**69**	**27**	**28**	**100**	**100**
1982	58	198	16	2 106	27	989	101	3 294
	57	**6**	**16**	**64**	**27**	**30**	**100**	**100**
1983	28	73	7	504	22	404	57	981
	49	**7**	**12**	**51**	**39**	**41**	**100**	**100**
Total	541	1 718	127	14 752	361	12 384	1 029	28 854
	53	**6**	**12**	**51**	**35**	**43**	**100**	**100**

Source: Adapted from "Summary of Spill Events in Canada, 1974 - 1983," Environment Canada, 1987.

The Melville Shipping Ltd. (MSL) report was prepared for the Government of Canada in November, 1991. The MSL report collected and analyzed reported marine pollution incidents for the period 1983 - 1987 using data compiled from six principal Canadian sources:

- Canadian Coast Guard spill data base;
- Canadian Coast Guard Pollution Patrol Program (designated DC-3 reports);
- Environment Canada - NATES;
- Government of the Northwest Territories;
- Various Canadian Ports; and
- Environment Canada regional offices.

The purpose of this report was to gauge the amount of marine pollution occurring in Canadian waters as a result of navigational accidents (collisions, groundings, strikings and other accidents) relative to pollution occurring through operations which include both intentional and unintentional spills. The pollutants include oil, oil products and certain non-oils.

Table 3.2 presents a summary of the data developed in the MSL report. This table highlights a number of interesting points:

- the number of annual average spill events as a result of collisions, groundings, strikings and miscellaneous accidents during this five year period is 28.6. This appears to be consistent with the number of annual events during the previous ten years although difference in spill categories makes a direct comparison difficult.
- the average spill per "collision et al." event is approximately 30 tonnes (for those events where the spill quantity is known), a considerable decrease from the previous ten years. [This trend may be a result of more numerous small spills now being reported.]

TABLE 3.2

Distribution of Reported Marine Spills by Cause in Canada (1983-1987)

Causes	Events	Volume (Where Known) litres	Ship Known	Quantity Not Known	Aerial Sightings
Accidents					
Collision	5	369 708	5	2	
Grounding	52	1 368 609	48	20	
Misc Accident	85	1 088 871	67	39	
Striking	1	0	1	1	
Subtotal	143	2 827 188	121	62	0
Operational Discharges					
Deliberate Discharge	59	140 858	37	33	
Emptying Tanks	18	28 153	18	4	
Error	83	502 716	62	11	1
Mechanical Failure	217	903 783	171	31	3
Other	74	62 569	32	48	1
Overflow	121	247 755	116	7	
Pumping Bilges	137	547 842	90	61	25
Unknown	374	232 170	190	186	78
Subtotal	1 083	2 665 846	716	381	108
TOTAL	1 226	5 493 034	837	443	108

Source: CCG Pollution Prevention Program Review, Melville Shipping Ltd., November 1991.

The MSL report provided certain observations concerning "operational" spills following their evaluation of the data base:

- 66% of "operational" spills entail less that 100 l (or no quantity involved);
- observed spills in excess of 6 000 l (approximately 5 tonnes) accounted for 5% of the events and 87% of material discharged;
- of the above, 18% of events (29% by volume) occurred offshore;
- the average "operational" spill, of those in excess of 6,000 l was 40 714 l; and
- the unintentional spills tended to be quite small and generally occurred inshore while the ship was at port or tied-up.

As a result of these observations, it appears that the category of spill events defined as "collision, grounding, striking et al." is the appropriate event in Canadian waters to focus the self-help evaluation since these events generally occur away from port, entail large quantities of spilled material and the crew may be willing and able to mitigate this pollution.

Although the "Public Review Panel on Tanker Safety and Marine Spills Response Capability - Final Report" did not provide significant oil spill information, the report did contain certain interesting observations concerning the potential for accidental marine oil spills in Canadian waters. This report determined that based upon existing levels of tanker traffic in Canadian waters, "Canada can expect over 100 small spills (less than one tonne), about 10 moderate spills (between one tonne and 100 tonnes), and one major spill (between 100 tonnes and 10,000 tonnes) each year. Additionally, a catastrophic spill (over 10,000 tonnes) might be expected once every 15 years".

This report also provided a review of recent vessel traffic and marine spills in Canadian waters categorized by six different regions. Table 3.3 provides a summary of this information.

The Transportation Safety Board of Canada provided, from their data base, the marine incidents which have occurred in and around Canadian waters since 1975 and which have resulted in major pollution. The Transportation Safety Board further advised that their data base pertains only to vessels sustaining damage and therefore may not represent all pollution incidents occurring in Canada waters.

Table 3.4 presents the information provided by the Tanker Safety Board of Canada. This catalogue of incidents also includes a few incidents occurring in U.S. waters but recorded in the Tanker Safety Board data base.

TABLE 3.3

Vessel Traffic and Marine Spills in Canadian Waters

Region	Description of Vessel Traffic	Recent Spill History in Region
Newfoundland and Labrador	1988 - 39 053 vessels reported to Newfoundland traffic centres 1988 - over 30 million tonnes crude transported by sea in this region	Three spills reported 1988 - 1990 1979 - "Kurdistan" collided with ice in Cabot Strait, breaking apart and spilling 7 000 tonnes oil.
Maritimes	1988 - 31.8 million tonnes of crude oil, 10.6 million tonnes refined product shipped to or through this region 1988 - 135 barge voyages transporting oil	Between 1975 and 1987, 74 tanker spills reported 1970 - "Arrow" ran aground spilling 7 000 tonnes oil.
St. Lawrence River	1988 - 19 000 ships transporting a total of 111 million tonnes crude and product	Between 1971 - 1988, 641 spills recorded of which 1 200 tonnes was spilled as a result of 19 marine accidents.
Great Lakes	1988 - 13 million tonnes oil products transported	No catastrophic spills.
Arctic	Seasonal tanker traffic (300 000 tonnes in 1988) in Eastern Arctic, tug/barge traffic (200 000 tonnes in 1988) in Western Arctic	Between 1981 - 1989, 121 incidents reported. 1980 - "Edgar Jourdain" went aground at Hall Beach spilling 50 000 litres.
West Coast	1988 - 4 million tonnes product shipped through Port of Vancouver. Tanker traffic from Alaska to U.S. West Coast	Between 1980 - 1987, 78 significant spills in this region including many originating outside the region.

Source: Public Review Panel on Tanker Safety and Marine Spills Response Capability - Final Report, September 1990.

3.1.3 Worldwide Marine Oil Spill Statistics

The statistics governing worldwide historical marine oil spills were accumulated from four principal sources:

- "Beaufort Sea - Mackenzie Delta Environmental Impact Statement" prepared by Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Limited, 1982;
- International Tanker Owners Pollution Federation Ltd.;
- Classification Society Det Norske Veritas; and
- United States, Department of the Interior, Minerals Management Service.

TABLE 3.4

Marine Incidents Resulting in Major Pollution
In and Around Canadian Waters
(1975 - November, 1991)

Date	Vessel Name	Type	Location of Incident	Description of Incidents	Oil Spill	Prime Cause	Comment
23/06/1976	Nepco 140	Oil Barge	1000 Islands, USA St. Lawrence Seaway	Contact with Bottom	Bunker C	Human Error	Grounded in fog: considerable pollution. Sea state: Calm
15/03/1979	Kurdistan	Tanker	Cabot Strait East Coast, Canada	Ice Damage	Crude	Ice combined with excessive speed	Vessel broke apart in ice, heavy weather sea state: rough
25/12/1979	Lee Wang Zin	Bulk Carrier	Dixon Entrance West Coast of Canada	Capsize	Ship's Diesel	Human Error	Sea state: rough
02/02/1985	Le Cedre No. 1 (formerly "Arthur Simard")	Tanker	St. Lawrence River	Contact with Bottom	Diesel	Human Error	Sea state: Heavy ice cover
17/10/1981	Unknown	-	St. Lawrence River Massena Canal, NY	-	Bunker C	-	Cause not known
27/06/1982	Imperial Acadia	Tanker	Cabot Strait Approach to Port-Aux-Basques	Grounding	Diesel	Human Error	Grounded on shoal; sea state: moderate
18/01/1983	Star Luzon	Bulk Carrier	North Vancouver, B.C.	Hull Puncture	Ship's Bunker	Hull-Miscellaneous	Puncture in fuel tank resulted in extensive pollution of Vancouver harbour
29/02/1984	Bute No. 3	Oil/Cargo Barge	Hecate Strait West Coast of Canada	Tow parted and adrift	Diesel	Human Error	Sea state: rough
09/09/1985	Daishin Marv No. 16	Fish Factory	St. John's Nfld. Harbour	Fire	Diesel	Human Error	Overflow while fueling, fire in engine room, vessel total loss
03/12/1985	McAsphalt 401 (formerly Point Levy)	Oil Barge	AuLarge De Metane, Quebec	Grounding	Bunker C	Equipment Failure	Barge broke tow and grounded, sea state: very rough
21/12/1985	Arco Anchorage	Tanker	Port Angeles, Washington USA	Grounding	Crude	-	Grounded entering harbour, ruptured into tanks

TABLE 3.4 (Cont'd)

Marine Incidents Resulting in Major Pollution In and Around Canadian Waters (1975 - November, 1991)

Date	Vessel Name	Type	Location of Incident	Description of Incidents	Oil Spill	Prime Cause	Comment
30/08/1986	Radium 352	Oil Barge	Lake Athabasca, Saskatchewan	Grounding	Diesel	Wind	Tug forced to abandon due to high wind and seas; barge grounded. Sea state: rough
09/01/1987	Stuyvesant	Tanker	Offshore NW of Vancouver Island	Hull Fracture	Crude	Seas	Vessel lost entire cargo (969,000 gal) enroute to Panama from Valdez. Sea state: very rough
04/10/1987	Stuyvesant	Tanker	150 mi West of Queen Charlotte Island, B.C.	Hull Fracture	Crude	Hull Welding	Fracture in cargo tank caused pollution; sea state: unknown
31/01/1988	Unknown	Barge	North of Paget Sound, Washington	Foundering	-	-	Barge total loss
22/04/1988	Athenian Venture	Tanker	375 mm South of Cape Race, Nfld.	Fire	Gasoline	-	Vessel caught fire; broke in two; bow sank
08/05/1988	Czantoria	Tanker	Levis, Quebec Harbour	Striking	Crude	Human Error	Struck quay on berthing
10/11/1988	Odyssey	Tanker	700 m E.N.E. of Cape Spear, Nfld.	Fire	Crude	-	Vessel caught fire, broke in two and sank; sea state: heavy
24/03/1989	Exxon Valdez	Tanker	Prince William Sound, Alaska	Grounding	Crude	Human Error	Sea State: Calm
26/07/1989	Lake Anne	Tanker	Snell Lock New York, USA	Striking	Chemical	Human Error	Vessel struck lock losing 7500 litres of xylene
15/11/1990	Berge Broker	Tanker	560 mm S.E. of Nova Scotia	Weather Damage	Crude	Seas	Sustained heavy weather damage enroute to Saint John, Nfld. Spilled 29000 mm; sea state: very heavy

As with the Canadian data, there undoubtedly are additional sources of statistics of worldwide marine oil spills. However, the sources identified above provided sufficient information and detail for the purpose of this study.

The "Beaufort Sea - Mackenzie Delta et al." report is now somewhat dated but did provide certain interesting information concerning accidental marine oil spills prior to 1979. Table 3.5 provides a summary of the 33 largest oil spills which occurred between 1967 and 1978. Table 3.6 provides the number of accidents and cause of marine oil spills occurring between 1967 and 1978. Table 3.7 presents this same accident data although distributed by size of spill.

The International Tanker Owners Pollution Federation Ltd. provided the historical marine oil spill data presented in Table 3.8. A recent report issued by this Federation identified the following observation concerning tanker spills:

> "Most spills from tankers occur in ports and at oil terminals during routine operations such as loading, discharging and bunkering. However, the majority of these spills are relatively small with over 90% involving quantities of less than 7 tonnes. In comparison, accidents such as collisions and groundings give rise to less than 10% of all spills from tankers but a fifth of these involve quantities in excess of 700 tonnes."

Table 3.9 provides spill data which supports this observation.

TABLE 3.5

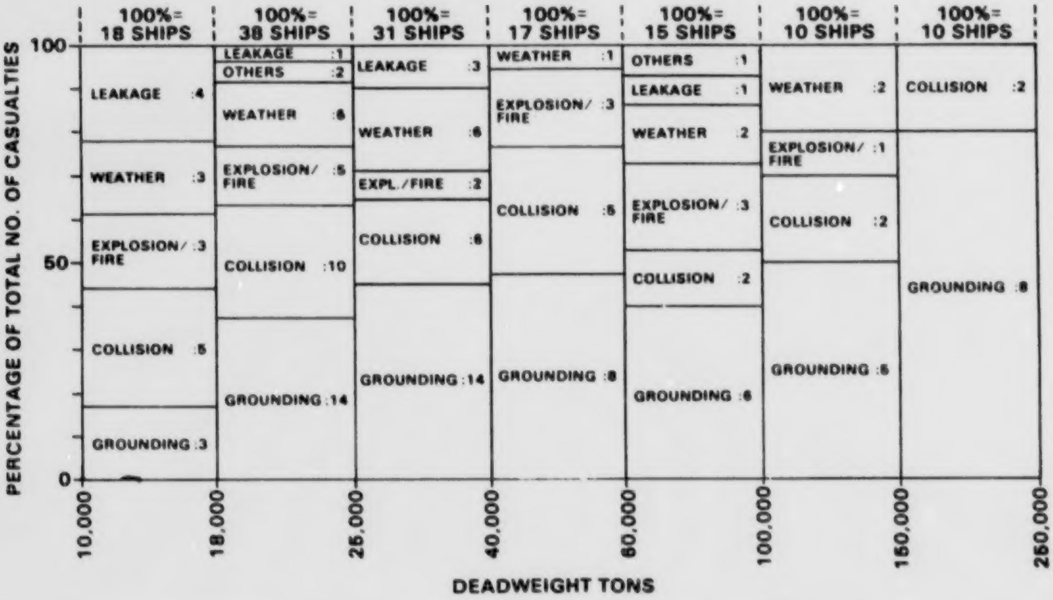
The 33 Largest Oil Spills from Tankers (1967-1978)

Tankers Name	Location	Approximate Spill Size (Tonnes)	Year
Amoco Cadiz	France	220 000	1978
Torrey Canyon	England	117 000	1967
Sea Star	Gulf of Oman	115 000	1972
Othello	Baltic Sea	100 000	1970
Hawaiian Patriot	Pacific Ocean	99 000	1976
Urquiola	Spain	88 000	1976
Jakob Maersk	Portugal	84 000	1975
Wafra	S. Africa	63 000	1971
Metula	Straits of Magellan	51 500	1974
Ennerdale	Indian Ocean (Seychelles)	41 000	1970
World Glory	Durban, S. Africa	45 600	1968
(unidentified)	SE Atlantic	37 000	1971
Napier	SE Pacific	36 000	1973
Texas Oklahoma	NW Atlantic	35 000	1971
Trader	Mediterranean	34 000	1972
St. Peter	SE Pacific	34 000	1976
Irene's Challenge	Pacific	34 000	1977
(unidentified)	Pacific	30 000	1972
Golden Drake	NW Atlantic	31 000	1972
Chryssi	NW Atlantic	31 000	1970
Kao	NW Atlantic	30 000	1969
Pacocean	NW Atlantic	30 000	1969
Caribbean Sea	E. Pacific	30 000	1977
(unidentified)	NW Atlantic	30 000	1972
(unidentified)	NW Atlantic	29 000	1970
Grand Zenith	NW Atlantic	29 000	1976
Cretan Start	Indian Ocean	29 000	1976
(unidentified)	Indian Ocean	28 000	1969
Argo Merchant	Cape Cod (USA)	30 000	1976
(unidentified)	NW Atlantic	28 000	1969
(unidentified)	NW Atlantic	28 000	1971
Giuseppe Guiletti	NW Atlantic	26 000	1972
Venoit/Venpet	S. Africa	24 000	1977

Source: Beaufort Sea - Mackenzie Delta Environmental Impact Statement, 1982

TABLE 3.6

Type of Casualty (1967-1978)
No. of and Percentage of Total No's. of Casualties in Given Deadweight Ranges



Source: Beaufort Sea - Mackenzie Delta Environmental Impact Statement, 1982.

Note: Deadweight tonnage (DWT) is the total carrying capacity of a ship expressed in long tons (1 long ton = 2240 pounds).

TABLE 3.7

Oil Spill Tanker Accidents (1967-1978)
No. of Vessel Accidents and Sizes of Oil Spills

Size Range of Oil Spills 'S'	Accidents		Total Oil Spilled	
	No. of	% of Total	Tons	% of Total Spilled
200 T < S ≤ 1 000 T	17	21.8%	9 750 T	0.6%
1 000 T < S ≤ 2 000 T	5	6.4%	6 620 T	0.4%
2 000 T < S ≤ 5 000 T	13	16.7%	47 255 T	2.9%
5 000 T < S ≤ 15 000 T	11	14.1%	118 250 T	7.2%
15 000 T < S ≤ 30 000 T	19	24.3%	444 880 T	27.0%
30 000 T < S ≤ 50 000 T	6	7.7%	232 819 T	14.2%
50 000 T < S ≤ 100 000 T	4	5.1%	327 000 T	19.9%
S > 100 000 T	3	3.8%	457 000 T	27.8%
	Total = 78		Total = 1 643 574 Tons	

Source: Beaufort Sea - Mackenzie Delta Environmental Impact Statement, 1982.

TABLE 3.8

Oil Spills Resulting From Accidents Involving Tankers, Combination Carriers and Barges

	Numbers of Spills Over 50 bbl		
Year	50-5000 bbl	>5000 bbl	Quantity ('000 tonnes)
1974	91	26	256
1975	98	22	368
1976	67	25	456
1977	65	19	316
1978	55	23	388
1979	57	35	760
1980	51	13	187
1981	49	6	50
1982	45	3	15
1983	52	12	330
1984	24	8	35
1985	29	8	110
1986	25	8	25
1987	25	20	35
1988	13	9	229
1989	20	14	200
1990	50	12	49

Notes:

1. Data for both tables has been compiled from the Federation's data base of oil spills from tankers, combination carriers and barges, excluding those resulting from acts of war. Reliable data on spills of over 50 barrels is held and the amounts spilled during those incidents have been added to give a series of annual volumes for the years 1974-1990.

2. The vast majority of spills are small (i.e. less than 50 barrels) and data on numbers and amounts is incomplete. However in most years it is probable that they make a relatively small contribution to the total quantity of oil spilled into the marine environment. In view of these factors an allowance has been made for these small spills by increasing by 12.5% the annual input figures for spills greater than 50 barrels.

3. Although data on larger spills is much more reliable, inevitably for some incidents the amounts spilled are estimates reflecting the fact that oil may have burnt or may remain in a sunken vessel. The magnitude of this uncertainty for spills over 5 000 barrels is in most years greater than the total amount lost as a result of these smaller spills (less than 50 barrels).

4. A very few large spills are responsible for a high percentage of the oil spills over 50 barrels, with a total amount of 958 thousand tonnes, but 532 thousand tonnes (56%) were spilled in just 10 incidents (just over 2%).

5. Clearly there is considerable annual variation in both the incidence of oil spills and the amounts of oil lost and so these figures, and any averages derived from them, are statistically dubious and should be viewed with caution.

Note: 1 bbl = 0.16 m^3
Source: International Tanker Owners Pollution Federation Ltd., May 1991.

TABLE 3.9

Comparison of Number of Incidents of World Oil Spills from Tankers, 1974-1990, Resulting from Routine Operations, Collisions and Groundings

Incident Spilled Quantity	Less than 7 tonnes		7-700 tonnes		Over 700 tonnes		Total	
Loading/ Discharging	3003	(91%)	260	(8%)	15	(1%)	3278	(100%)
Bunkering	556	(96%)	23	(4%)	--		579	(100%)
Collison	119	(34%)	150	(46%)	69	(20%)	347	(100%)
Grounding	19	(44%)	155	(36%)	86	(20%)	433	(100%)
TOTAL	3870	(83%)	597	(13%)	170	(4%)	4637	(100%)

Source: Oil Companies International Maritime Forum and the International Tanker Owners Pollution Federation Ltd. 1990.

Figure 3.1 provides the percentage distribution, by type of casualty, for all marine accidents of vessels over 100 gross registered tons between the years 1978 and 1989 inclusive as recorded by the marine classification society Det Norske Veritas. Figure 3.2, by comparison, provides the percentage distribution, by type of casualty, for those marine accidents which resulted in a pollution incident over the same period. These latter percentages increase for all casualty categories with the exception of hull/machinery failure and fire/explosion.

The most complete historical marine oil spill data base obtained by this study was received from Minerals Management Services (MMS). The MMS database is valid for spills over 136 tonnes occurring from 1974 to June, 1990. This database was compiled from a number of worldwide sources including but not limited to:

- U.S. Coast Guard;
- Det Norske Veritas;
- World Information Systems;
- Institut Français du Pétrole;
- Oil Spill Bulletin;
- Oil Spill Intelligence Report; and
- Golob's Oil Pollution Bulletin.

The data base includes 681 events providing the information described in Table 3.10 for each event.

Table 3.11 provides a summary of the MMS database although this table reflects events occurring with vessels having minimum 6 000 DWT prior to 1983, 10 000 DWT thereafter with no minimum spill size. Table 3.12 provides a listing from this data base of the marine accidents causing the greatest amount of spilled material during the period 1974-1990.

The MMS data base has been utilized to analyze historical worldwide marine oil spills. This data base also includes certain events in Canadian waters so that

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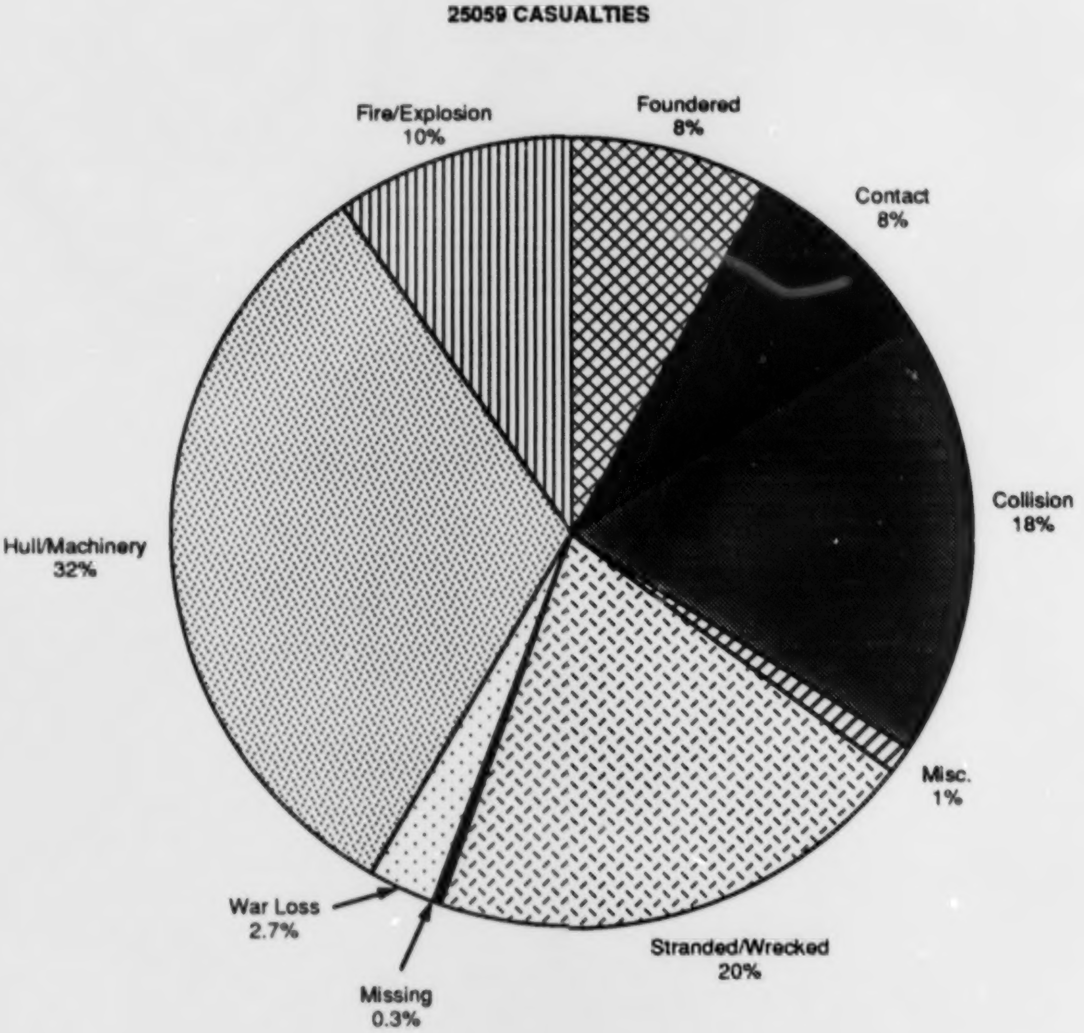
FIGURE 3-1

CASUALTY CATEGORIES

WORLD FLEET > 100 GRT 1978-1989



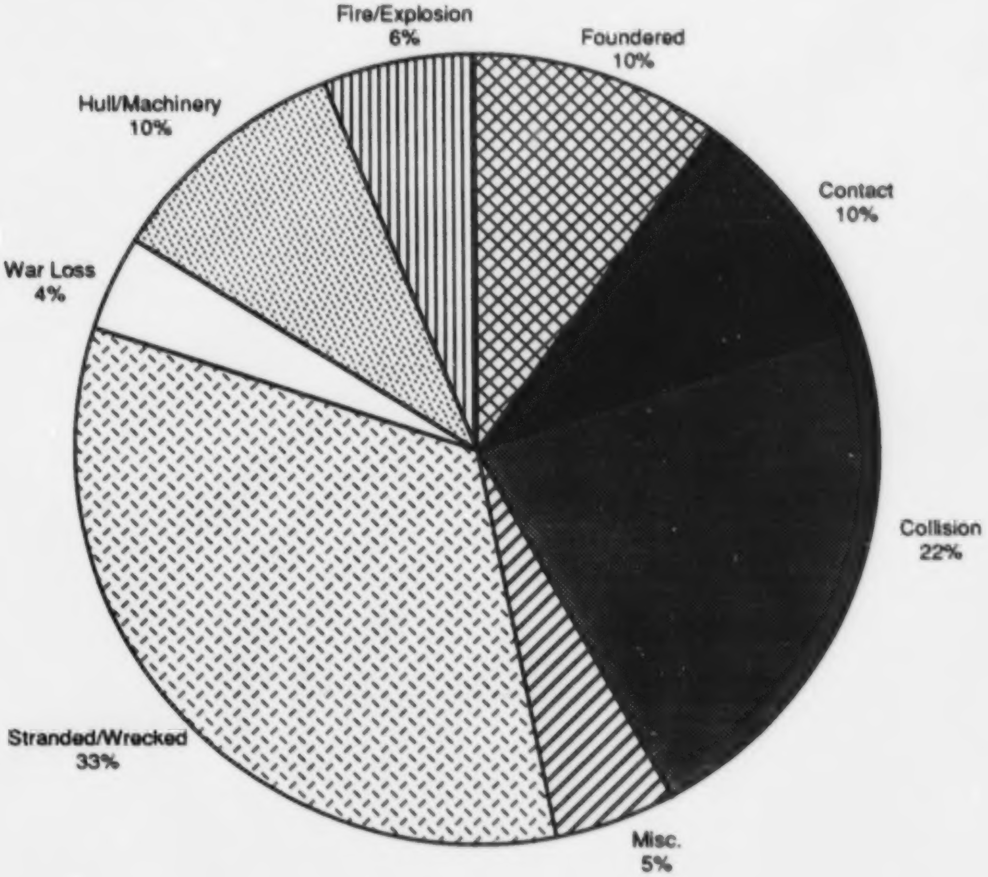
Source: Det norske Veritas Classification A/S

FIGURE 3-2

CASUALTY CATEGORIES vs. POLLUTION INCIDENTS

WORLD FLEET > 100 GRT 1978-1989

952 CASUALTIES



Source: Det norske Veritas Classification A/S a comparison of worldwide and Canadian marine spill characteristics might be undertaken. The complete listing of the 681 spills which have occurred worldwide is unfortunately too voluminous to include in the main text of this study. Rather this information is presented in Appendix A of this report. The incidents within this data base purported to occur within Canadian waters numbers 22. This information is provided in Table 3.13. A complete listing of events by spill quantity is provided in Appendix B.

TABLE 3.10

Information Provided by the U.S. Minerals Management Services' Tanker Spill Data Base

Data Documentation	Description
- Day of Event	
- Month of Event	
- Year of Event	
- Vessel Name	
- Vessel Type	Tanker or Barge
- Vessel Flag	
- Vessel Size	Deadweight Tons
- Vessel Gross Registered Tonnage	
- Vessel Year of Construction	
- Level of Load Prior to Spill	Full, Partial, Empty, Ballast or Unspecified
- Spill Amount	
- Lowest Volume Reported	Same as Spill Amount if Only One Report
- Highest Volume Reported	Same as Spill Amount if Only One Report
- Type of Oil Spilled	Crude Oil, Refined Oil, or Unspecified
- Description of Oil Type	
- Location of Spill in U.S. Waters	Yes or No
- Latitude of Spill Location	Degrees and Minutes
- Longitude of Spill Location	Degrees and Minutes
- Marsden Square	General Location of Spill
- Description of Spill Location	
- Type of Waters of Spills	Harbour, Pier, Restricted (0-50 Miles from Coast), Open (Over 50 Miles from Coast)
- Location of Spill	At Sea, At Port or Inland
- Cause of Casualty	Grounding, Collision, Capsize, Contact, Deliberate, Discharge, Explosion, Fire, Founder, Structural, Leakage, Mechanical, Other
- Number of Fatalities	
- Biological Losses	
- Impact Upon Habitats and Coastline	
- Source of Spill Information	

TABLE 3.11

Spills from Tankers
Worldwide (1974-1990)

Year	Crude Oil Spills		Refined Product Spills		All Product Spills	
	No. of Spills	Spillage in Barrels	No. of Spills	Spillage in Barrels	No. of Spills	Spillage in Barrels
1974	15	797 181	26	717 751	41	1 514 932
1975	19	1 831 256	22	519 996	41	2 351 252
1976	18	1 905 135	22	969 200	40	2 874 335
1977	15	1 884 014	22	702 832	37	2 586 846
1978	17	3 083 730	23	466 527	40	3 550 257
1979	21	3 789 795	29	1 009 128	50	4 798 923
1980	11	1 509 241	24	341 247	35	1 850 488
1981	7	43 350	19	408 615	26	451 965
1982	6	230 556	15	91 755	21	322 311
1983	13	2 231 078	16	335 165	29	2 566 243
1984	6	189 585	21	135 915	27	325 500
1985	5	560 178	22	173 974	27	734,152
1986	6	63 085	9	121 851	15	184,936
1987	11	109 698	8	178 493	19	288,191
1988	7	1 178 224	4	279 572	11	1,457,796
1989	12	1 136 149	21	140 676	33	1,276,825
1990	8	195 905	7	108 405	15	304,310

Historically, the sources for "Federal Offshore Statistics" (FDS) Table 67 have been (1) Lloyd's of London, who generally are concerned only with the vessels that they insure, and (2) the U.S. Coast Guard (USCG), which maintains the records for U.S. waters. Neither of these sources claim to be comprehensive worldwide.

Comparison of previous editions of Table 67 in FDS with this year's table show that the TAG data base sometimes reports fewer spills but much more volume spilled for each year. This is because TAG counts only spills of 1,000 barrels and greater, but is reasonably comprehensive worldwide. Table 67 only controls vessel size (6 000 DWT before 1983 and 10 000 DWT for 1983 and on) with no minimum spill size. Although FDS increases the count of total incidents (over the TAG data base) by using spills smaller than 1 000 barrels, it misses some of the large worldwide spills that are not in Lloyd's or the USCG's scope of reporting.

The TAG worldwide tanker spill data base, 1974-1980, was originally established in 1983 under a contract with World Information Systems. Source references to this original data are: Det Norske Veritas, Tanker Casualty Library from Lloyd's of London, and World Information Systems. Since 1983, TAG has maintained and verified the data base in-house. U.S. Coast Guard data have been added annually. Additional Information has been incorporated from the Institut Francais du Petrole tanker data bank for the years 1974-1987. The Oil Spill Bulletin was utilized for events between 1985-1987, after which the bulletin ceased publication. Current information is generally gathered from the Oil Spill Intelligence Report (OSIR), Golob's Oil Pollution Bulletin, newspaper accounts, and various reports concerning oil spill events. The most recent updates to the data base include OSIR's 1989-1990 International Spill Statistic Summary (March 1991); World Information Systems report on "Tanker Losses in U.S. Water: 1978-1989"; and data from the National Academy of Sciences report "Tanker Spills: Prevention by Design" (February 1991). Each spill event in TAG's database includes the source references for the data.

The advantage of using the TAG data base are that each individual spill included in the tabulation can be listed, and one or more data sources have been identified for each spill. The data have been presented in a peer-reviewed publication and at several scientific conferences, and are available to the public. In addition, there are specific criteria that can be clearly identified as to why a spill was included in the database. All the spills in the TAG data base must be from a vessel, generally a tanker or barge, which carried a petroleum product as cargo. The spill may be cargo or fuel for the petroleum carrier. The spill must be at least 1 000 barrels in size (42 000 gallons, 136 metric tons, 134 long tons, 300 800 pounds, 149 cubic meters). Table 67 now begins with the year 1974 rather than 1969. In 1973, the international tanker spill reporting requirements changed. These changes resulted in more accurate and comprehensive reporting in 1974 and later.

Source: MMS/TAG Worldwide Tanker Spill Database

TABLE 3.12 MMS TANKER SPILLS (1974 – 1990)

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
AMOCO CADIZ	LIB	OFF PORTSALL, BRITTANY NWEST FRANCE	220279	78	MACHINE OTHER AGROUND
CASTILLO DE BELLVER	SPA	75 KM S. AFRICA, NW CAPE TOWN	189483	83	FIRE HULL RUPT BROKE–IN–2 FOUNDER ABANDON
ODYSSEY	LIB	730 MI. NE OF ST.JOHNS,NEWFOUNDLAND	139619	88	WEATHER STRUC FAILURE FIRE FOUNDER
ATLANTIC EMPRESS	GRE	30 KM NE TRINIDAD–TOBAGO	138335	79	WEATHER COLLISN LEAKAGE FIRE
ATLANTIC EMPRESS	GRE	450KM EAST OF BARBADOS	134383	79	FOUNDER
IRENES SERENADE	GRE	NAVARINO BAY, OFF PILOS, GREECE	118562	80	EXPLOSN FIRE FOUNDER
URQUIOLA	SPA	LA CORUNA, SPAIN	100725	76	AGROUND FIRE EXPLOSN ABANDON
INDEPENDENTA	RUM	BOSPORUS STRAIT, ISTANBUL, TURKEY	93576	79	PERSONNEL ERROR COLLISN EXPLOSN FIRE AGROUND
HAWAIIAN PATRIOT	LIB	320 MI W OF HAWAII (KAUAI I.)	84811	77	WEATHER HULL RUPTLEAKAGE EXPLOSN FIRE FOUNDER
JAKOB MAERSK	DAN	PORT LEIXOES, N. PORTUGAL	78576	75	WEATHER AGROUND EXPLOSN FIRE BROKE–IN–2
NOVA (NOYA?)	LIB	140KM S OF KHARG IS ARAB. GULF	70952	85	COLLISN W/ PAN TANKER MAGNUM
KHARK 5	IRA	100 MI. OFF COAST OF MOROCCO–ATLANT	64898	89	WEATHER COLLISION HULL RUPTURE FIRE
ASSIMI	GRE	RAS AL HADD, 58 MI. FROM MUSCAT	51566	83	FIRE FLOODING BROKE–IN–2 EXPLOSION FOUNDER
YUYO MARU 10	JAP	TOKYO BAY, JAPAN	49864	74	COLLISION W/SHIP FIRE EXPLOSION SCUTTLED
ANDROS PATRIA	GRE	BAY OF BISCAY,CAPE FINISTERRE,SPAIN	47210	78	WEATHER HULL RUPT LEAKAGE EXPLOSN FIRE
METULA	HOL	SATTELITE BANK,MAGELLAN STR., CHILE	45165	74	PERS ERR AGROUND HULL RUPT WEATHER ABANDON
BRITISH AMBASSADOR	BRI	180 MI. W. OF IWO JIMA I, PACIFIC	44898	75	NAVIGATING LEAK TOW WEATHER FOUNDER
GINO	LIB	40 MI. OFF COAST OF BRITTANY,FRANCE	41886	79	WEATHER, COLLISION W/ TEAM CASTOR, FOUNDER
TADOTSU	LIB	GULF OF OMAN	39864	78	NAVIGATING NO CAUSE CITED
PERICLES G. C.	GRE	ARABIAN GULF, 200 MI ENE DOHA QATAR	38912	83	FIRE EXPLOSION ABANDON LISTING CAPSIZE
JUAN A. LAVALLEJA	URU	OFF ARZEW, ALGERIA	35504	80	WEATHER CONTACT AGROUND
BRAZILIAN MARINA	LIB	SAO SEBASTIAO, BRAZIL	35310	78	AGROUND LEAKAGE
BURMAH AGATE	LIB	4 MI. FR ENTR. GALVESTON BAY, TEXAS	34661	79	COLLISN W/ MIMOSA FIRE EXPLOSN AGROUND
ATHENIAN VENTURE	CYP	350–400 MI. SE OF CAPE RACE, NEWFO.	34344	88	EXPLOSION FIRE SPLIT FOUNDER
IRENES CHALLENGE	LIB	200 MI (320 KM SE) OF MIDWAY ISLAND	33907	77	STRUCTR BROKE–IN–2 FOUNDER
SAINT PETER	LIB	30 MI W OF PUNTA MANGLARES,COLOMBIA	33907	76	FIRE EXPLOSN ABANDON
EXXON VALDEZ	USA	BLIGH REEF, P. WILLIAM S. VALDEZ AK	32721	89	AGROUND
ELLEN CONWAY	LIB	MED. SEA, OUTER HARB ARZEW, ALGERIA	29932	76	NAVIGATING, UNKNOWN
IOANNIS ANGELICOUSSIS	GRE	CABINDA GULF OIL, MALONGO, ANGOLA	29932	79	MACHINE AGROUND
JAPAN GALATHUS	JAP	PERSIAN GULF	29932	78	EXPLOSN FIRE TOWED ABANDON FOUNDER
SCORPIO	GRE	GULF OF CAMPECHE?,11 MI FR PORT,MEX	29932	76	NAVIGATING, AGROUND HULL RUPT
CRETAN STAR	CYP	450 MI OFF BOMBAY, INDIA	29918	76	WEATHER LEAKAGE STRUCTR FOUNDER
GOLDEN CRANE	LIB	MID–NORTHERN INDIAN OCEAN	28921	77	HIGH SEAS EXPLOSION
GRAND ZENITH	PAN	ATLANTIC O., MASSACHUSETTS	28921	76	HIGH SEAS STRUCTURAL DAMAGE
HARALABOS	LIB	RAS GHARIB, GULF OF SUEZ	27366	82	LOADING EXPLOSION FIRE AGROUND
BETELGEUSE	FRE	BANTRY BAY, IRELAND	26864	79	UNDLOADING FIRE EXPLOSN SPLIT–IN–2 FOUNDER
BORAG	LIB	REEF 4 KM OFF TAIWAN (NR. YEH–LIU)	26112	77	AGROUND LEAKAGE WEATHER FOUNDER
AL SABRIYAH	KUW	40 MILES OFF JAPAN	24898	77	WEATHER LEAKAGE STRUCTR
CARIBBEAN SEA	PAN	S. OF EL SALVADOR CENTRAL AMER.	24717	77	WEATHER MACHINE LEAKAGE FOUNDER
ARGO MERCHANT	LIB	45 KM SE OF NANTUCKET, MA	24295	76	PERSONL AGROUND
ARAGON	SPA	N. ATLANTIC NE OF ISLAND OF MADEIRA	23810	89	HEAVY SEAS CAUSED TANK PLATING BREAK
VENOIL	LIB	32 KM OFF SOUTH AFRICA	23216	77	WEATHER MACHINE COLLISN W/VENPET FIRE AGROUND
TITIPOR	GRE	TOMANAUS ROADS, BRAZIL	21497	79	CONTACT EXPLOSN FIRE
CAVO CAMBANOS	GRE	TARRAGONA ROADS, OFF CORSICA	20269	81	ENGINE ROOM EXPLOSION FIRE SCUTTLED
AMINONA	GRE	ATLANTIC O., BANCO DO MEIO, BRAZIL	19946	78	AGROUND
MASTER STATHIOS	GRE	50 MI. DURBAN, S. AFRICAN INDIAN O	19946	75	FIRE
IKUYO MARU	JAP	PERSIAN GULF	19864	78	NAVIGATING
THEODOROS V	GRE	MID–ATL., 400M N OF DAKAR, SENEGAL	19864	74	EXPLOSION STRUCTURAL DAMAGE
URSS 1	RUS	RIVER NEAR BLACK SEA, BOSPHORUS	19864	77	HIGH SEAS, EXPLOSION FIRE FOUNDER
ZAVYETY ILYICHA	RUS	INDIAN OCEAN	19864	80	NAVIGATING, EXPLOSION
SPARTAN LADY	LIB	12–200 MI. OFF NEW JERSEY	19436	75	WEATHER STRUCTR HULL RUPT BROKE–IN–2 SCUTTLED
NANYANG	SOM	S. CHINA SEA, 90 MI E OF HONG KONG	17655	76	COLLISN W/STRAAT ALGOA FOUNDER
PNOC BASILAN	PHI	S CHINA SEA OFF AGOO, PHILLIPINES	17007	83	WAVE STRUCTR FIRE EXPLOSION FOUNDER
SALEM (DELIBERATELY SUNK)	LIB	ATLANTIC O, S OF GAMBIA, W. AFRICA	15918	80	FRAUD/MUTINY? FIRE EXPLOSION ABANDON FOUNDER
AL DAMMAM	ARA	MEDITERRANEAN,AGIOI THEODOROI,GREE	14966	76	NAVIGATING, FIRE
CHERRY VINSTRA	SIN	ARABIAN SEA, GULF OF OMAN	14966	74	NAVIGATING, EXPLOSION AND FIRE
KURDISTAN	BRI	CABOT STRAIT, N. SCOTIA,CANADA	14966	79	CONTACT ICE RAMMING SCUTTLED

TABLE 3.13 MMS DATABASE CANADIAN OIL SPILLS (1974 – JUNE 1990)

				VESSEL							SPILL								
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR
1	4	8	74	JOS. SIMARD	T	CAN	7,153	0	64	UNSP	1,458	1,458	1,458	2	NO. 4 DIESEL FUEL	F	58:43N	062:54W	187
2	26	8	74	IRVINGWOOD	T	CAN	3,000	0	52		499	499	499	2	GASOLINE	F	UNSP	UNSP	151
3	30	9	74	GOLDEN ROBIN	T	BRI	28,175	17,539	53	UNSP	499	283	499	2	NAPHTHA/BUNKER C	F	48:05N	066:22W	152
4	30	6	76	J. R. GREY	T	LIB	0	0	0		272	247	272	1	CRUDE	T	45:18N	065:59W	151
5	21	1	77	IMPERIAL BEDFORD	T	UNS	14,204	0	0	UNSP	181	181	181	2	NO. 2 FUEL	F	46:14N	063:09W	151
6	11	11	77	RICHMOND DREDGER	T	UNS	0	0	0	UNSP	363	363	363	2	DIESEL FUEL	F	49:07N	123:04W	157
7	20	12	77	GOLDEN EAGLE	T	UNS	0	0	0	UNSP	175	175	175	2	FURNACE OIL	F	47:10N	055:09W	150
8	0	3	79	SIMONBURN	T	BRI	32,017	0	0	FULL	10,883	10,883	10,883	2	NO. 6 FUEL	F	46:56N	059:40W	150
9	15	3	79	KURDISTAN	T	BRI	32,531	0	73	UNSP	14,966	12,731	14,966	2	BUNKER C/NAPTHA	F	46:55N	059:39W	150
10	19	3	79	LIGHT CANSO	T	UNS	0	0	0	UNSP	784	784	823	2	NO. 2 DIESEL FUEL	F	45:19N	060:55W	151
11	16	2	82	MAKHANIK TARASOV	T	RUS	5,000	0	76		359	359	499	2	HEAVY FUEL/BUNKER	F	UNSP	UNSP	150
12	25	6	82	IMPERIAL ACADIA	T	CAN	10,475	0	0		272	272	272	2	DIESEL FUEL	F	UNSP	UNSP	151
13	7	12	83	IRVING ESKIMO	T	UNS	38,213	0	0		136	136	136	2	FUEL OIL	F	UNSP	UNSP	151
14	29	2	84	BUTE NO. 3 (BARGE)	B	CAN	0	0	0		172	172	172	2	DIESEL FUEL GASOLINE	F	53:28N	131:58W	194
15	1	7	84	ARCTIC LINK	T	UNS	0	0	0		590	590	590	2	BUNKER DIESEL LUBE	F	54:18N	058:00W	186
16	3	12	85	POINTE LEVY (BARGE)	B	UNS	0	0	0		272	156	272	2	BUNKER C	F	48:51N	067:33W	151
17	4	9	86	BARGE	B	UNS	0	0	0		256	256	256	2	P40 DIESEL	F	UNSP	UNSP	227
18	13	1	87	TANKER?	T	USA	0	0	0		2,041	2,041	2,041	1	CRUDE	F	51:29N	136:16W	194
19	21	4	88	ATHENIAN VENTURE	T	CYP	31,000	0	75		34,344	26,927	34,344	2	UNLEADED GAS./BUNKER	F	42:30N	049:30W	149
20	8	5	88	CZANTORIA	T	LIB	0	0	0		408	408	408	1	CRUDE	F	UNSP	UNSP	152
21	10	11	88	ODYSSEY	T	LIB	65,000	0	71		139,619	136,054	139,619	1	NORTH SEA CRUDE	F	53:00N	045:00W	185
22	25	7	89	NANCY ORR GAUCHER	T	LIB	0	2,899	0	PARTIAL	249	249	249	2	ASPHALT	F	43:30N	079:40W	152

TABLE 3.13 MMS DATABASE CANADIAN OIL SPILLS (1974 – JUNE 1990)

	LOCATION			CASUALTIES				REFERENCE SOURCE	
	PLACE	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME	
1	NEWFOUNDLAND, CANADA	PIER	P	MACHINE	0			WIS	
2	ST. LAWRENCE R., QUEBEC, CANADA	HARB	I	COLLISION W/ SHIP	0				
3	GULF OF ST. LAWRENCE,N.[illegible] UN,CANADA	RESTR	S	CONTACT AGROUND	0			MAR – WIS	
4	BAY OF FUNDY, MAINE – NOVA SCOTIA	HARB	P	STRUCTR	0			MAR WIS	
5	NOVA SCOTIA, CANADA	HARB	P	MACHINE	0			WIS	
6	BRITISH COLUMBIA, CANADA	HARB	P	OTHER	0			WIS	
7	NEWFOUNDLAND, CANADA	RESTR	S	WEATHER STRUCTR	0			WIS	
8	65 KM NE OF SYDNEY, NOVA SCO.	RESTR	S	CONTACT WEATHER	0			MAR	
9	CABOT STRAIT, N. SCOTIA,CANADA	RESTR	S	CONTACT ICE RAMMING SCUTTLED	0			WIS ENVCAN – 7/87	79SUM
10	STRAIT OF CANSO, NOVA SCOTIA	RESTR	S	AGROUND	0			WIS ENVCAN – 7/87	
11	NORTH ATLANTIC O. OFF NEWFOUNDLAND	OPEN	S	WEATHER LEAK LISTING	33				5.8
12	OFF PORT AUX BASQUES, NEWFOUNDLAND	RESTR	S	AGROUND	0				5.27
13	ST. LAWRENCE RIVER, NR QUEBEC	HARB	P	RUPTURE	0				6.49
14	GRAHAM I., BRITISH COLUMBIA	RESTR	S	AGROUND	0				7.9 9.47
15	LAKE MELVILLE, LABRADOR	HARB	P	GROUNDING	0	4 OILED BIRDS			9.47
16	MATANE, QUEBEC GULF OF ST. LAWRENCE	RESTR	S	AGROUND	0	200 BIRDS OILED			9.47
17	CANADA, NW TERRITORIES, HAY R.	HARB	I	NEGLIGENCE	0				86SUM
18	OFF BRITISH COLUMBIA (0–3 MI.)	RESTR	S	STRUCTR HULL RUPT	0				
19	350–400 MI. SE OF CAPE RACE, NEWFO.	OPEN	S	EXPLOSION FIRE SPLIT FOUNDER	29			CA STATE LANDS C1990	11.18 88SUM
20	ST. ROMULAD, QUEBEC	HARB	I	TANK RUPTURE	0				88SUM
21	730 MI. NE OF ST JOHNS,NEWFOUNDLAND	OPEN	S	WEATHER STRUC FAILURE FIRE FOUNDER	27			CA STATE LANDS C1990	11.47, 88SUM
22	HAMILTON HARBOR, ONTARIO, CANADA	PIER	I	UNLOADING TANK OVERFLOW	0		ASPHALT INTO HARBOR		

TABLE 3.13 MMS DATABASE CANADIAN OIL SPILLS (1974 – JUNE 1990)

	REFERENCE SOURCE				
	OCB	CGUARD	IFP	GOLOB	COMMENTS
1			7434		
2			7441		
3			7445		
4		829			
5					
6					
7					
8					
9			7917		SCUTTLED S. OF SABLE ISLAND 4/1/79
10					ENVCAN SHOWS AS CANSO LIGHT ON 2/2/79
11			8208		
12					
13					
14					
15					
16	5.1				
17					
18		350			
19			8813		
20					
21			8827		
22				11.7	

3.2 Spill History Analysis

The MMS Tanker Spill data base was assessed based on spill volumes, and the vessel type (size) associated with the majority of oil spills. By relating these two criteria, this study tried to identify the typical oil spill scenario, including weather, cause, location, etc.

Spill scenarios that are not very common, yet are responsible for large spill volumes, have been characterized and a spill scenario will be assembled. Both the common type of spill scenarios and the less common but larger spill scenarios were used as a basis for assessing the self-help systems.

A listing of the MMS worldwide oil spill data base is divided into two sections based on chronological order. The first section covers the time period from 1974 to 1982 inclusive, and the second section covers 1983 to June 15, 1990 inclusive (Appendix A). The following are the requirements for an incident to be included in the MMS database:

- the source of the spill must be a vessel, generally a tanker or barge, on which a petroleum product was cargo. The spill may be cargo or fuel for the petroleum carrier;
- the spill must be at least 136 metric tonnes (1 000 barrels) in size; and
- the spill must be accidental, and acts of war have not been included.

This comprehensive listing of spill information was utilized as a primary source of evaluating trends in tanker oil spill history. Information on smaller spills is much more limited.

3.2.1 Vessel Accidents and Spill Size

Table 3.14 presents a distribution of the number of accidents by spill size. The data shows that 15.9% of all accidents spill 84.5% of the total oil volume. The spill range between 15 000 and 30 000 tonnes contributes up to 17% of the total volume spilled, and spill sizes over 100 000 tonnes, although only 1.0% of the total number of accidents, represent 27.7% of the total oil spilled.

Table 3.15 and 3.16 present the same type of breakdown as Table 3.14, but are divided into two separate time periods, 1974 to 1982 inclusive and 1983 to June 1990. The purpose of separating the data was to determine if there was any trend in spill volume over the period of the entire data base.

The data from 1974 - 1982 (Table 3.15) shows a similar pattern to the 1974 - June 1990 data. The spill size range of 15 000 tonnes to 30 000 tonnes represents 21.5% of the total amount spilled, and the size range of spills greater than 100 000 tonnes represents 25.5% of the total amount spilled.

The data from 1983 - June 1990 (Table 3.16) also shows a trend towards a small percentage of the number of spills responsible for the greatest amount of the total oil spilled.

The spill size distribution from these tables demonstrates a basic trend of how the greatest amount of oil is spilled. Focusing on the circumstances surrounding the larger spills, such as vessel size, establishes a starting point for defining a typical and an atypical oil spill scenario.

A review of the Canadian accidents also suggests the same trend. Table 3.17 shows 83.5% of the total spill volume results from 9% of the total number of accidents.

TABLE 3.14

Oil Spill Marine Accidents
Number of Vessel Accidents and Spill Amounts
(1974 - June 1990)

Size Range of Oil Spill 'S' (Tonnes)	Accidents		Total Oil Spilled	
	Number of	% of Total	Tonnes	% of Total Spilled
136 < S ≤ 500	271	39.8	88 152	2.3
500 < S ≤ 1000	142	20.9	113 603	3.0
1 000 < S ≤ 5 000	160	23.5	382 298	10.2
5 000 < S ≤ 15 000	54	7.9	505 201	13.4
15 000 < S ≤ 30 000	27	4.0	639 896	17.0
30 000 < S ≤ 50 000	14	2.1	548 153	14.6
50 000 < S ≤ 100 000	6	0.9	444 380	11.8
S > 100 000	7	1.0	1 041 385	27.7
TOTAL	681	100	3 763 068	100

TABLE 3.15

Oil Spill Marine Accidents
Number of Vessel Accidents and Spill Amounts
(1974 - 1982 Inclusive)

Size Range of Oil Spill 'S' (Tonnes)	Accidents		Total Oil Spilled	
	Number of	% of Total	Tonnes	% of Total Spilled
136 < S ≤ 500	172	37.6	45 710	2.0
500 < S ≤ 1000	99	21.7	81 182	2.9
1 000 < S ≤ 5 000	101	22.1	246 682	8.8
5 000 < S ≤ 15 000	41	9.0	393 648	14.1
15 000 < S ≤ 30 000	25	5.5	599 080	21.5
30 000 < S ≤ 50 000	11	2.4	442 177	15.9
50 000 < S ≤ 100 000	3	0.7	256 964	9.2
S > 100 000	5	1.1	712 283	25.5
TOTAL	457	100	2 788 725	100

TABLE 3.16

Oil Spill Marine Accidents
Number of Vessel Accidents and Spill Amounts
(1983 - June 1990)

Size Range of Oil Spill 'S' (Tonnes)	Accidents		Total Oil Spilled	
	Number of	% of Total	Tonnes	% of Total Spilled
136 < S ≤ 500	99	44.2	31 442	3.2
500 < S ≤ 1000	43	19.2	32 421	3.3
1 000 < S ≤ 5 000	59	26.3	135 616	13.9
5 000 < S ≤ 15 000	13	5.8	111 553	11.4
15 000 < S ≤ 30 000	2	0.9	40 816	4.2
30 000 < S ≤ 50 000	3	1.3	105 977	10.9
50 000 < S ≤ 100 000	3	1.3	187 416	19.2
S > 100 000	2	0.9	329 102	33.8
TOTAL	224	100	974 343	100

TABLE 3.17

Oil Spill Marine Accidents in Canadian Waters
Number of Accidents and Spill Amounts
(1974 - June 1990)

Size Range of Oil Spill 'S' (Tonnes)	Accidents		Total Oil Spilled	
	Number of	% of Total	Tonnes	% of Total Spilled
136 < S ≤ 500	14	64	3 884	1.9
500 < S ≤ 1000	3	13.6	2 832	1.4
1 000 < S ≤ 5 000	1	4.5	2 041	1.0
5 000 < S ≤ 15 000	2	9.1	25 849	12.4
15 000 < S ≤ 30 000	0	0	-	0
30 000 < S ≤ 50 000	1	4.5	34 344	16.5
50 000 < S ≤ 100 000	0	0	-	0
S > 100 000	1	4.5	139 619	67
TOTAL	22	100	208 549	100

3.2.2 Vessel Size Distribution

A breakdown of the data base by vessel size distribution is presented in Table 3.18. There were two main vessel size ranges that were involved in oil spill accidents consisting of vessels 108 000 DWT and less, and vessels between 50 000 to 100 000 DWT. A correlation of vessel size and spill volume is given in Table 3.19. For all spills greater than 58 000 tonnes (a listing which is provided in Appendix C), the table shows that vessels between the range from 20 000 DWT to vessels greater than 250 000 DWT account for 84% of the total number of vessels, spilling 92% of the volume. As a first approximation, vessel sizes within this category and larger will provide a basis for developing self-help concepts for oil spill scenarios that cause the largest problem.

TABLE 3.18

Vessel Worldwide Size Distribution
Oil Spill Accidents
(1974 - June 1990)

Vessel Size Range (V) (DWT)	Number of Accidents
V ≤ 10 000	109
10 000 < V ≤ 20 000	35
20 000 < V ≤ 30 000	54
30 000 < V ≤ 50 000	77
50 000 < V ≤ 100 000	105
100 000 < V ≤ 250 000	74
V > 250 000	24
Unspecified	203
TOTAL	681

TABLE 3.19

Worldwide Vessel Size Distribution
for all Spills Greater than 5,000 Tonnes
(1974 - June 1990)

Vessel Size Range (V) (DWT)	Number of Accidents	Spill Volume (tonnes)
V < 10 000	3	21 212
10 000 < V ≤ 20 000	12	168 681
20 000 < V ≤ 30 000	13	237 960
30 000 < V ≤ 50 000	17	409 729
50 000 < V ≤ 100 000	19	629 848
100 000 < V ≤ 250 000	24	993 742
V > 250 000	11	644 173
Unspecified	9	73 671
TOTAL	108	3 179 015

3.2.3 Cause of Oil Spills

An analysis of the spill data base by cause (Table 3.20) shows that the most common cause of all the accidents can be attributed to groundings. Collisions were the second main cause of spills, except for the Canadian data, which shows structural failure to be the second main cause. Other causes include fire/explosions, operations, strikings, unknown and other. It should be remembered that the information in this data base is for spills of 134 tonnes and over. Information and statistics from other data bases will vary depending on their own criteria.

TABLE 3.20

Worldwide Spills by Cause
(1974 - 1982)

Cause	% of Total (1974-1982)	% of Total (1983-June 1990)	% of Total (Canadian)
Groundings	29.1	26.2	22.7
Collisions	23.9	22.9	4.6
Strikings	6.4	5.1	13.6
Structural Failure	12.3	6.0	18.2
Fire/Explosions	14.0	6.4	4.6
Operations	6.1	14.2	13.6
Weather	2.4	13.8	13.6
Unknown/Unspecified	2.2	3.7	0
Other	3.7	1.8	9.1

Most groundings occur as a result of navigational and steering errors. Misreading of charts or out of date charts are the cause of navigational errors, while misjudging wind, current and turning capability cause steering accidents (Dome, 1982). Groundings are most common at night, and visibility is generally good.

Poor visibility is a condition most closely associated with collisions. The MMS database does not detail weather conditions; however, previous studies have shown that thick fog is very common in accidents of this nature (Dome, 1982). Quite often the crews will be aware of the other's presence, but fail to take appropriate action. The most common collision scenario involves a head-on encounter, at fairly substantial speeds with poor visibility. Mistakes are made by misinterpreting the proper marine rules.

For the other causes of oil spills listed in Table 3.20, most can be related to human failure. Structural failure, fire/explosions, operations and strikings occur usually out of neglect of the ship, poorly trained personnel or poor weather conditions (Dome, 1982).

3.2.4 Spill Locations

3.2.4.1 Geographical Locations

The MMS data base provides information on the geographical location of the oil spills utilizing what is known as a Marsden number. This system is based on a worldwide grid system with a number designating each of the rectangles on the grid. The database provides the Marsden number for each of the oil spills, giving the general locations of where the spills occurred. Figure 3.3 shows the worldwide spill locations from 1974-1982, and Figure 3.4 shows the spill locations from 1983 - June 1990 inclusive. The locations of oil spills in Canadian waters are found in Figure 3.5.

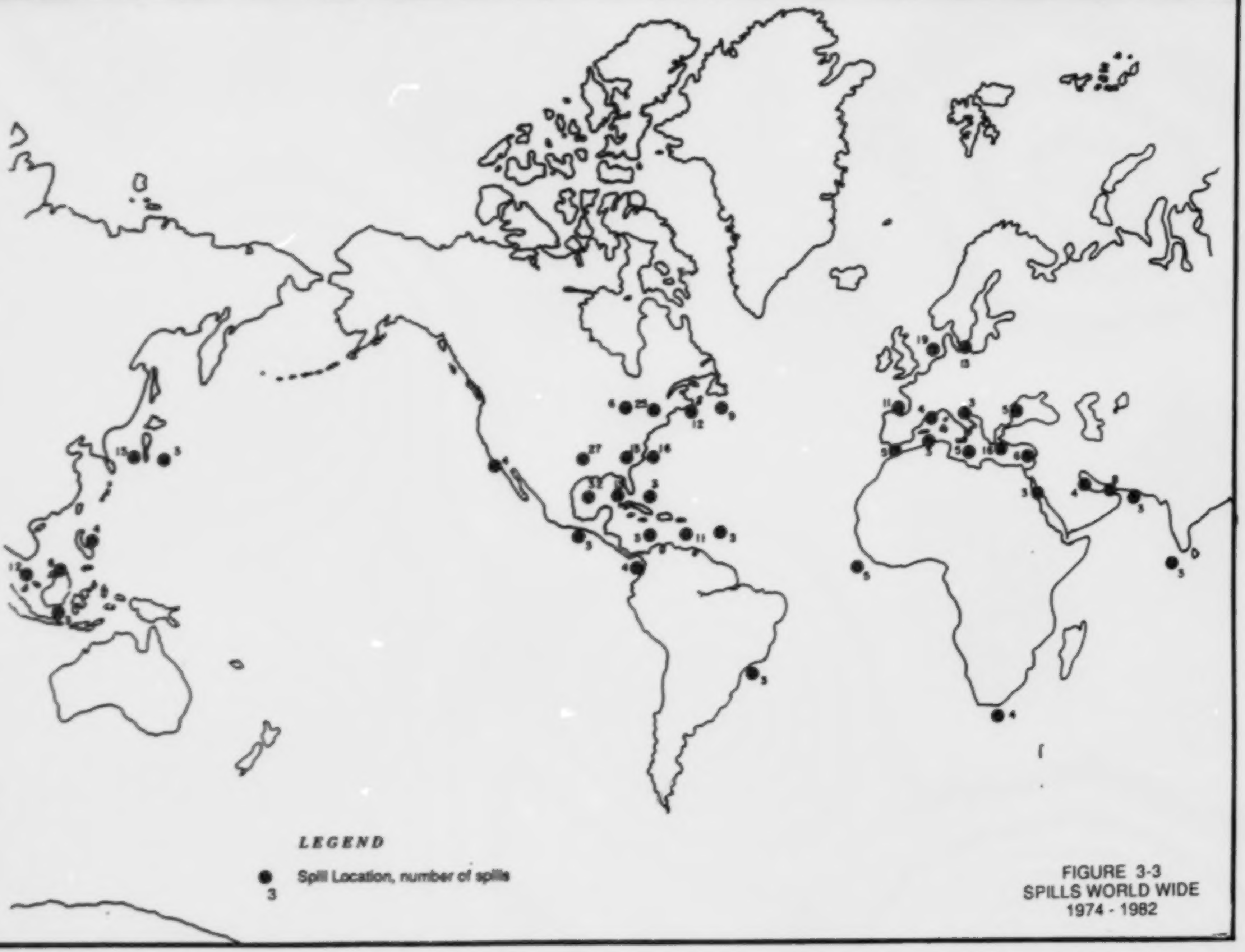


FIGURE 3-3
SPILLS WORLD WIDE
1974 - 1982

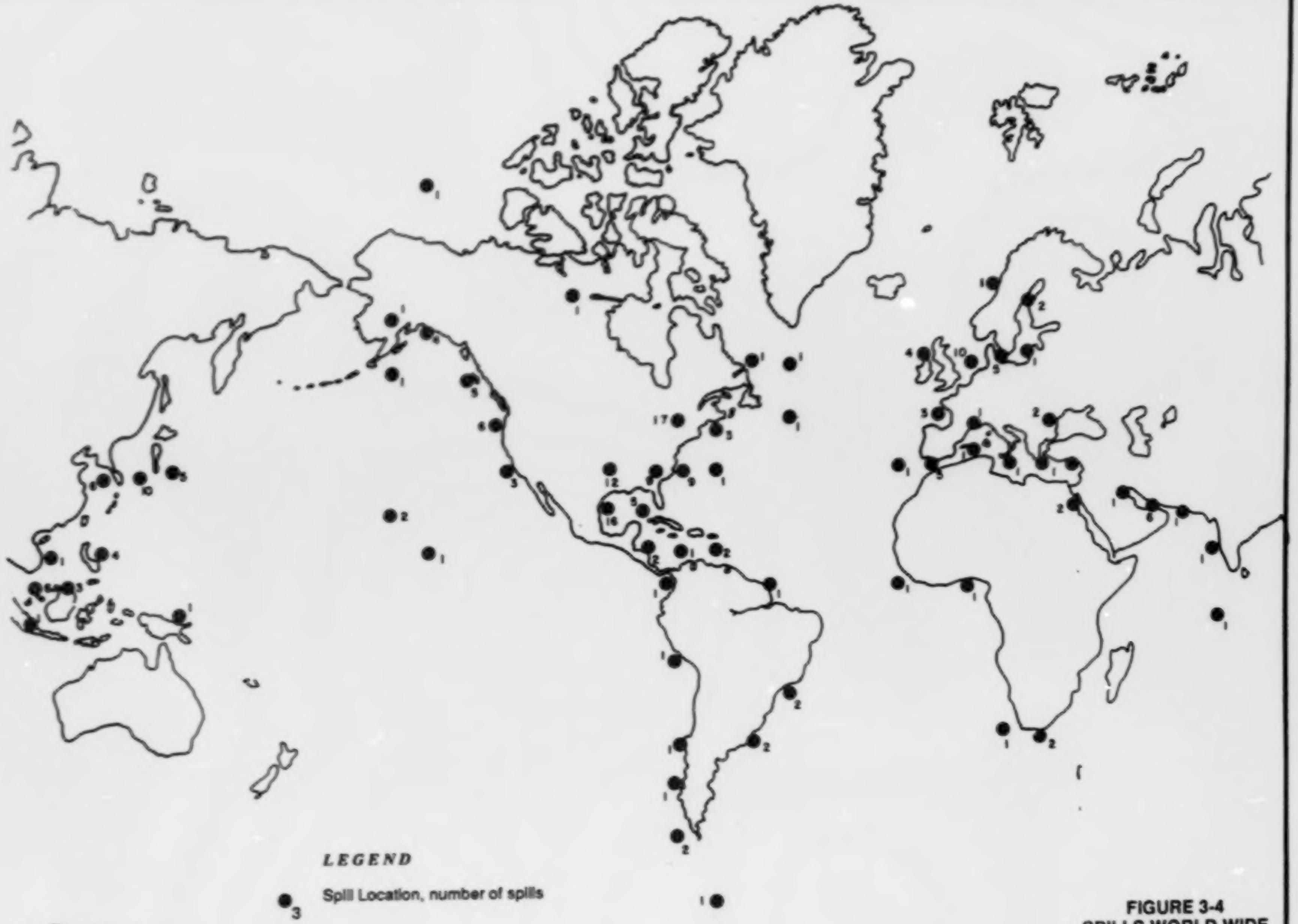
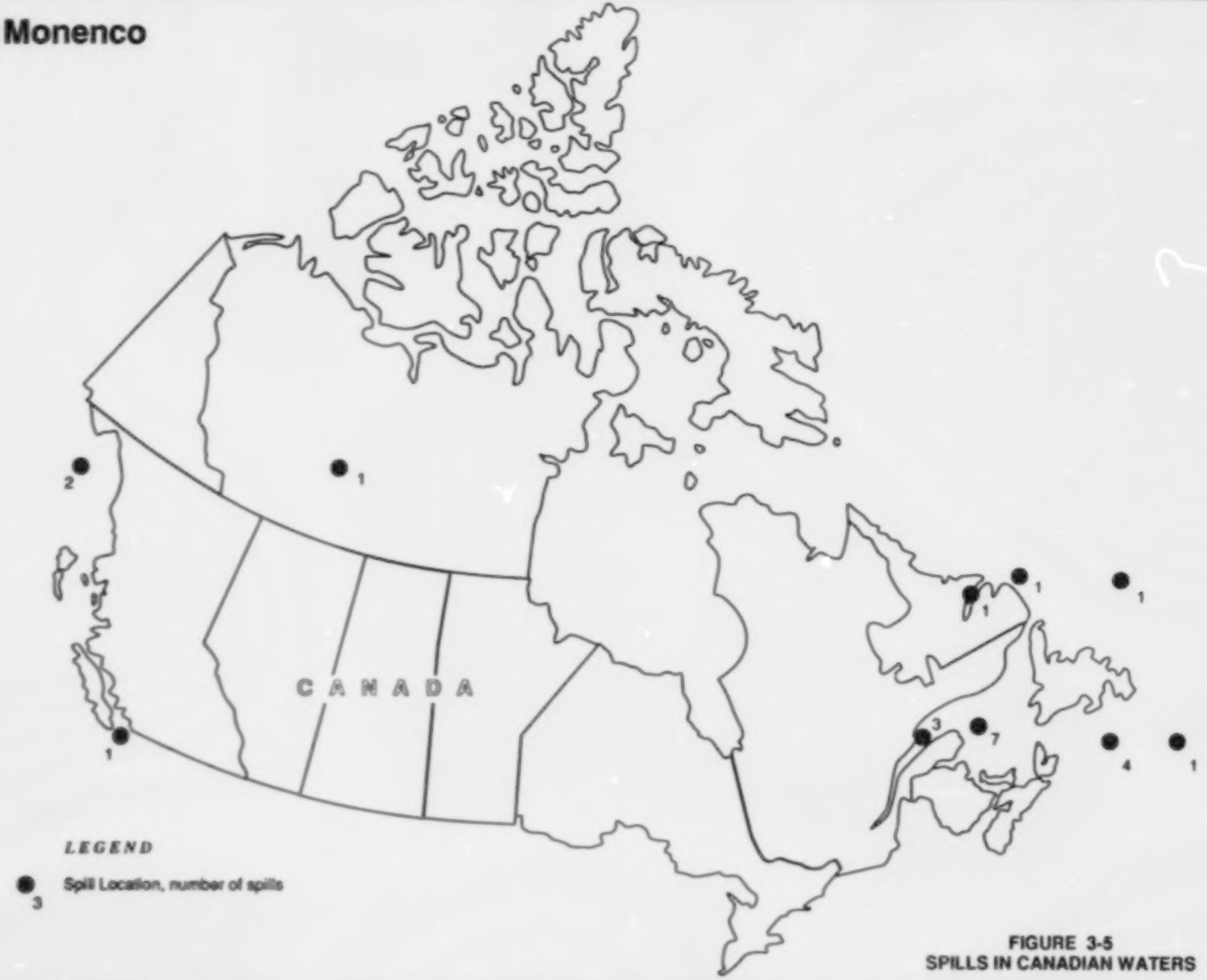


FIGURE 3-4
SPILLS WORLD WIDE
1983 -1990

Monenco



LEGEND

● 3 Spill Location, number of spills

FIGURE 3-5
SPILLS IN CANADIAN WATERS

The worldwide spill locations in Figure 3.3 and 3.4 most likely also reflect major marine traffic areas. The Canadian map shows the majority of oil spills occurring in the Maritimes. This area transports the majority of petroleum cargo in Canadian waters (Brander-Smith Report, 1990).

3.2.4.2 Water Locations

An analysis of water locations for the spill data base is presented in Table 3.21. The water location is defined in terms of where the spill occurred relative to the shoreline. Four categories are utilized to describe the locations; harbour, pier, restricted water and open water.

TABLE 3.21

Worldwide Location in Water Where Spills Occurred (1974 - June 1990)

Water Location	Number of Accidents	Spill Volume (tonnes)
Harbour[a]	186	439 511
Pier[b]	82	476 763
Restricted[c]	328	1 798 703
Open[d]	83	1 042 351
Unspecified	2	881
TOTAL	681	3 763 068

For Spills Over 5000 Tonnes

Water Location	Number of Accidents	Spill Volume (tonnes)
Harbour[a]	12	285 480
Pier[b]	15	388 574
Restricted[c]	52	1 501 061
Open[d]	29	982 820
TOTAL	108	3 178 015

For Canadian Spills
1974 - June 1990

Water Location	Number of Accidents	Spill Volume (tonnes)
Harbour[a]	8	2 705
Pier[b]	2	1 707
Restricted[c]	9	30 064
Open[d]	3	174 322
TOTAL		208 798

[a] Harbour - includes inland waterways
[b] Pier - at pier or dock, or in the act of docking
[c] Restricted - 0-50 miles from coast; default if type of water is unknown
[d] 50+ miles from coast

Most spills (including the most volume spilled) occur in restricted waters, which in this case is defined as being from 0-50 miles from the coast. This was true for the entire data base, as well as for spills over 5 000 tonnes only. It is possible that the majority of spills categorized as occurring in restricted waters are happening very close to the shoreline, as opposed to 50 miles from the coast.

Harbour and pier spill volumes tend to be limited since vessel crews supported by shore-based personnel are generally able to respond immediately to an event, and support equipment is usually much more readily available than is the case with offshore events.

3.2.5 Load Level

In a spill scenario, the load level will in part dictate the flowrate of oil leaking from the vessel. A full cargo load will produce a high pressure differential across the tank wall, whereas a partial cargo load will have a smaller pressure difference, resulting in a lower flowrate of oil escaping from the vessel.

A review of vessel load level prior to spilling is presented in Table 3.22, for spills greater than 5 000 tonnes. The majority of vessels were carrying a full load prior to spilling, accounting for 70% of the total spill volume. Empty load levels are second on the list, accounting for 17% of the total spill volume. Partial load levels account for 5% of the total volume spilled.

TABLE 3.22

Worldwide Level of Load Prior to Spill
for Spills >5000 Tonnes
(1974 - June 1990)

Level of Load	Number of Accidents	Spill Volume (tonnes)
Full	57	2 228 212
Partial	8	148 881
Empty	25	547 400
Ballast	1	8 932
Unspecified	17	248 480
Total	108	3 179 015

3.2.6 Spill Distribution by Flag

Tankers carrying petroleum cargos are required by law to be registered. Vessels can be registered under the flags of various countries, and are then subject to the regulations set out by those countries.

An analysis of the data base demonstrates high frequencies of accidents and quantity of oil spilled occurring under certain flags (See Table 3.23). Of interest is the number and size of spill accidents associated with vessels registered under the Liberian and Greek flags. A total of 176 accidents were responsible for 50% of the total volume of oil spilled from 1974 to June 1990. Different registration requirements and inspection protocols may be the reason for this. Further, as a flag of convenience, a greater percentage of the world fleet size might be registered as Liberian and Greek. A summary of oil spills in Canadian waters Table 3.12 includes the flag of the vessel. Only four of the 22 events identified in this Table were caused by vessels of Canadian registry.

Table 3-24 presents the incidents included within the MMS data base and in/around Canadian waters, identified by the flag of the vessel.

3.3 Summary

The preceding analysis of historical worldwide and Canadian marine oil spills provides the following observations:

- marine oil spills of 5 000 tonnes and greater account for 39.4% of the accidents, yet 94.7% of the total spilled quantity.
- of marine oil spills of 5 000 tonnes or greater, 84% of spills (by number of accidents) occur from events caused by vessels 20 000 DWT and larger.
- over 50% of spills are caused by events (groundings, collisions, strikings) where the vessel crew might potentially be able to respond in mitigating the outflow of oil.
- 78.5% of spills over 5 000 tonnes occur outside of harbour or pier areas where oil spill response equipment is presumably not immediately available.
- comparison of spill events during 1974-1982 and 1983-1990 indicate a smaller number of events during the latter period, but a relatively consistent distribution of spill amounts throughout the total period. Distribution of the causes of the event was also reasonably consistent throughout this period.

As a consequence, the data suggest that a tanker spill self-help system may have merit since the majority of spill events result in a situation whereby the tanker crew might potentially respond to mitigate the outflow of oil, since the event is likely to occur outside the harbour where independent spill response equipment is not immediately available. The data also suggests that a system designed to combat/mitigate spills of 5 000 tonnes and greater, and vessel size of 20 000 DWT and greater appears an appropriate "threshold" for evaluation since this captures the events creating the vast majority of marine oil spill volume.

TABLE 3.23

Spill Distribution by Flag Worldwide
(1974 - June 1990)

Flag	Number of Accidents	Total Spill Quantity (tonnes)
Liberian (LIB)	99	1 090 862
Greek (GRE)	77	802 311
Spanish (SPA)	6	319 918
American (US)	160	193 731
Japanese (JAP)	40	162 596
Panamanian (PAN)	35	128 637
British & British Colonies (BRI)	20	115 984
Danish (DEN)	6	95 720
Romanian (RUM)	2	94 224
Cyprus (CYP)	12	88 287
Iranian (IRA)	2	71 053
Russian (RUS)	12	58 932
Unknown (UNS)	59	58 708
Dutch (HOL)	4	46 534
Philippine (PHI)	9	44 056
Uruguayan (URU)	2	36 476
Kuwaiti (KUW)	4	34 747
Singapore (SIN)	11	29 372
French (FRE)	6	29 356
Italian (ITA)	9	24 604
Norwegian (NOR)	7	24 455
Indian (IND)	3	22 831
Saudi Arabian (ARA)	4	22 144
Iraqi (IRQ)	2	18 199
Somalian (SOM)	1	17 655
Gibraltar (GIB)	1	14 023
Chilean (CHI)	4	13 102
Swedish (SWE)	11	10 384
South Korean (KOR)	8	10 213
Venezuelan (VEN)	2	10 135
Bahrain (BAH)	1	7 978
Ligure (LIG)	2	7 978
Portuguese (POR)	3	7 020
East German (DDR)	1	6 807
Maltese (MAL)	1	5 485
West German (WGE)	6	4 377
Brazilian (BRA)	2	3 971
Argentinian (ARG)	4	3 497
Chinese-Taiwan (TAI)	2	3 223
Canadian (CAN)	6	3 001
Dominican (DOM)	2	2 792
Honduran ((HON)	3	2 393
Cuban (CUB)	1	1 995
Finnish (FIN)	3	1 795
Belgian (BEL)	2	1 695
Turkish (TUR)	3	1 608
Moroccan (MOR)	2	1 496
Paraguayan (PER)	1	1 490
Algerian (ALG)	1	1 476
Trinidad & Tobago (TRI)	1	1 361
Thailand (THA)	1	767
Ecuadorean (ECU)	2	726
Sierra Leone (SL.)	1	499
Malaysian (MLS)	1	499
South African (SAF)	1	298
Polish (POL)	1	259

TABLE 3.24

Canadian Marine Oil Spill Incidents by Vessel Flag

Level of Load	Number of Accidents	Spill Volume (tonnes)
Liberia	4	140 348
Cyprus	1	34 344
British	3	28 378
Unspecified	8	2 757
Canadian	4	2 401
American	1	2 041
Russia	1	358

4. SYSTEM DESIGN SPECIFICATION

In the event of a marine accident, the crew of the vessel have priorities in ensuring the safety of the vessel and of those aboard, assessing the damage to the vessel and stabilizing her condition, and communicating with appropriate regulatory and response organizations. The vessel crew also has a responsibility to control or, if possible, stop the outflow of pollution during this period, once the greater priority of vessel safety has been realized.

Materials, equipment and/or procedures might be placed onboard vessels to allow the crew of that vessel to more effectively limit, and perhaps mitigate the effects of a pollution incident. To accomplish this task, such onboard equipment and/or procedures must be:

- realistic;
- practical;
- easily deployed;
- easily understood, operated and/or performed by the vessel crew;
- safe; and
- effective.

These must be the principal design and operational philosophies of a tanker self-help system.

Figure 4.1 depicts graphically the procedures used in evaluating candidate tanker self-help systems. The design approach is to develop a list of system specifications based upon a definition of the problem.

Table 4.1 presents the problem definition while Table 4.2 presents the tanker self-help system specifications derived for this investigation. Further definition of each of the items listed in this table follows.

4.1 Problem Definition

A marine incident resulting in an oil spill is an unpredictable event. As developed in the previous chapter of this report, marine incidents resulting in oil spills occur for a wide variety of reasons. In some incidents, the vessel suffers very limited damage while in others the vessel is a total loss. The incidents occur in a variety of geographical locations from harbours, shorelines, inland waters and lakes to the open ocean. Depending upon the location of the incident, support, external to the vessel, may or may not be readily available. The incidents occur in a wide variety of environmental conditions ranging from clear, calm weather and seas to severe wind, rain and seas, to cold temperature and ice.

Table 4.1 further elaborates upon the wide variety of conditions surrounding the historical marine oil spills. The intent of this "problem definition" is to demonstrate that a tanker self-help system must be effective in these wide variety of conditions. This situation, plus practical design factors, leads to the development of a "specification" for a tanker self-help system (Table 4.2).

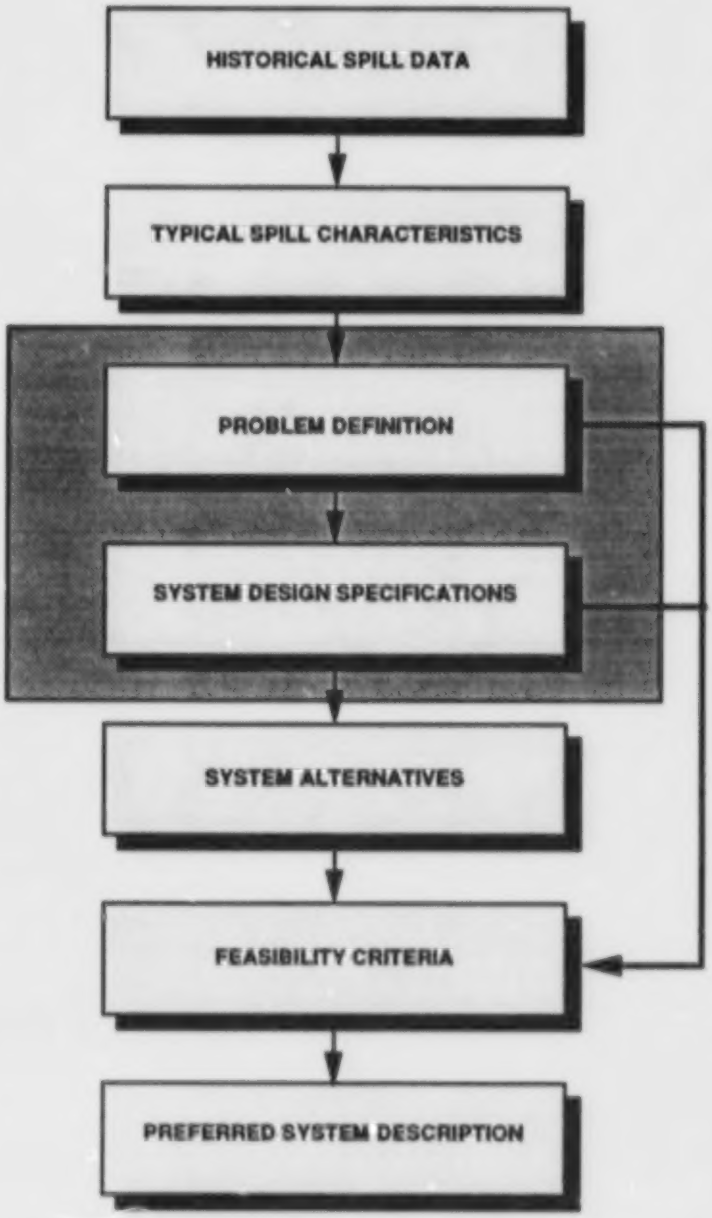

HISTORICAL SPILL DATA
TYPICAL SPILL CHARACTERISTICS
PROBLEM DEFINITION
SYSTEM DESIGN SPECIFICATIONS
SYSTEM ALTERNATIVES
FEASIBILITY CRITERIA
PREFERRED SYSTEM DESCRIPTION

FIGURE 4-1
SYSTEM DEVELOPMENT

TABLE 4.1

Tanker Self-Help Problem Definition

Problem Definition

1. Oil spill accidents occur in sea water and inland water, at any possible distance from the coastline.
2. The accident itself is an unpredictable event allowing relatively no time for preparedness.
3. The extent of damage to the vessel is unpredictable, and dependent upon the accident circumstances.
4. Vessels in accident events must contend with crew safety, ship safety and ship stability as first priorities, limiting the available manpower and equipment to dedicate towards the spill mitigation.
5. The quantity of oil that may spill can vary from small to large, depending on extent of damage, load level, and ship/cargo design.
6. Sea state and weather conditions greatly influence the Tanker Self-help system design, usefulness and effectiveness.
7. Vessel services may not be available after incident.
8. The incident has occurred and there is a requirement for spill self-help on the vessel.

4.2 System Specification

A tanker self-help system, to be effective, must recognize the following design constraints:

Vessel Services: Following an incident, it is possible that ship's services may not be available. A tanker self-help system must recognize that external electrical power, hydraulic power, compressed air, water amongst other utilities may not be present.

Rapid Deployment: Generally, an incident is easiest to control at an early stage. Additionally the sooner these controls are instituted, the less pollution damage is likely to occur. The tanker self-help system should recognize this situation by being readily available and deployable in a short period of time.

Reliability: The tanker self-help system should be reliable. In this regard, the system should be proven and have a "reasonable" shelf-life. This latter constraint is necessary since, hopefully, the self-help system will be rarely deployed. For functional and economic reasons, the system should not have to be continually replenished simply as a result of the expiring of effective "shelf-life". A limited shelf-life will accordingly influence the reliability of the system.

Simplicity: It is possible that the vessel crew may not be experienced or familiar with the tanker self-help system. With all of the distractions present immediately following an incident, the vessel crew may not be able or willing to operate the system according to previous instruction or as designed. Additionally, there may be a limited number of crew members available for deployment of the system. As a result, the tanker self-help system must be very simple to deploy, and operate. The system ideally should not require many persons, nor external equipment, to function.

TABLE 4.2

Tanker Self-Help System Specifications

System Specifications

1. System must recognize that ships services might not be available following the incident.

2. Be readily available for operation in a short period of time.

3. System must be proven and reliable, with reasonable "shelf-life".

4. System should be readily deployable by crew members, both in ease of operation and manpower intensity.

    - simple instructions
    - small crew able to deploy
    - simple deployment mechanism
    - existing vessel outfit.

5. Be portable and space saving for variety of vessel types, ie. 20 foot container.

6. Provide the best possible containment/recovery that is technically available.

    - efficient

7. Be operational without external help.

    - self-sufficient system, without relying on shoreside response.

8. Be adaptable to a variety of oil types.

9. Be functional for the anticipated weather and sea states.

10. Means of mobilizing/demobilizing the system to/from the vessel must be available.

11. Must be suitable for a range of spill locations, spill discharge rates and spill spread rates.

12. System must be safe.

Portable: It is impossible or impractical to consider under current international regulation having a tanker self-help system aboard every vessel likely to enter Canadian waters. Consequently, the system may have to be transferred to/from the vessel upon entering/exiting Canadian waters. The system, therefore, should be easily transportable, easily transferred and readily stowed aboard the vessel. The size and weight of the system must be considered.

Efficiency: The tanker self-help system must be effective in controlling, and/or mitigating, the effects of an oil spill. As described below the system must be effective for the wide variety of conditions for which the system might be utilized.

Self-Contained: The system must be deployed and operational with the equipment and personnel available on the tanker. The benefits of the system would be greatly compromised if shoreside support equipment and personnel must be mobilized to the tanker to allow operation of the self-help system.

Effective in a Variety of Oils: The historical spill data identified marine pollution incidents involving a wide variety of cargoes ranging from chemicals, residual fuels and crudes to light products and gasolines. Table 3.4 of this report identified major pollution incidents in Canadian waters involving this same wide variety of cargoes. The tanker self-help system should be effective for this range of oils. It may not be practical or economic to consider a different tanker self-help system for each type of oil, particularly when combined with the many other variables involved.

Effective in a Variety of Environmental Conditions: The historical marine oil spill data base identified that marine pollution incidents occur in a wide range of environmental conditions. These conditions include temperature, wind, visibility, precipitation, sea states, ice amongst others. The tanker self-help system should be deployable and operationally effective in as great a variety of environmental conditions as possible.

Effective in a Variety of Spill Locations: A marine pollution incident could occur in a harbour, inland waterway, adjacent to a shoreline or well offshore. The marine pollution incident could occur alongside an environmentally sensitive region. The tanker self-help system should be effective in all these locations.

Effective for a Variety of Spill Discharge and Spill Rates: The historical marine accidents identified that the vessels involved sustained a wide variety of damage ranging from small punctures of the hull, to the breaching of multiple cargo tanks to total constructive loss. The extent and location of the damage, the design of the vessel amongst other factors results in a great variance of spill discharge and spread rates. The tanker self-help system should be effective for as wide a range of discharge and spill rates as possible.

Safety: Above all, the tanker self-help system should be safe for the vessel, her crew and the environment. The system must not present more deficiencies than it is designed to control. As example, the system should not present greater environmental risk than the pollution, should not increase risk of fire and/or explosion aboard the tanker and should not jeopardize crew safety through operation of inappropriate equipment such as deployment vessels.

This briefly describes the objectives, requirements and constraints of the tanker self-help system. The candidate self-help systems is then described and evaluated based upon this catalogue of "system constraints".

5. SYSTEM OPTIONS

Numerous operational and technical solutions to Tanker self-help have been proposed in the literature in recent years. Some seem obvious while others are extensions of available technology. In this section, these options are presented and described. They are then evaluated as to their relative effectiveness and practicality in the next section.

Tanker self-help options fall into three general categories, inside tanker options, and outside tanker options and others.

The inside tanker options work by containing oil inside the vessel, utilizing onboard equipment to a maximum extent. These options work to prevent oil from spilling, rather than trying to recover it after it has spilled into water.

The outside tanker options are methods that treat, recover or dispose of the oil once it is in the environment. They generally do not rely on the tanker's equipment as much and are more influenced by the existing environmental conditions for their effectiveness.

A third category of tanker self-help options are mentioned briefly. This section includes contingency planning as an option. The subject of structural/design initiatives is mentioned briefly for information purposes only. Options requiring a structural/design change are not included within the scope of work for this study.

5.1 Inside Tanker Options

5.1.1 Liners/Temporary Patching

A liner system consists of the placing of a durable material inside vessel cargo tanks (along the sides and the bottom) as a barrier for oil spill leakage. In the event of an accident where the hull of the vessel is damaged (rupturing the cargo tank) the liner ideally remains intact, containing the oil within.

The implementation of a liner system requires that the structural elements within a cargo tank are arranged in a way that allows maneuverability for the liner (NAS, 1989). Equipment, gauges, structural members and piping found in a typical tank would impede the liners effectiveness, therefore requiring a major retrofitting and redesign of the cargo tanks to accommodate the liners. Consequently, a permanent liner system is considered as a structural option (see Section 5.3), not a tanker self-help option as defined in this scope of work. No further evaluation of liners will be considered.

Temporary patching entails having the equipment and/or procedures available onboard the tanker to allow her to conduct temporary repairs thereby reducing, or possibly stopping the outflow of oil. There are a number of potential concepts related to temporary patching, none of which could be considered proven for application aboard an oil tanker. One such concept entails having aboard spare steel plates which might be deployed over the side in the event of rupture or puncture of the tanker hull. This plate would be held in place against the hull, in part by hydrostatic pressure, and would serve to reduce the area of outflow. Temporary patching may warrant consideration as a "candidate" self-help system in the future, but in view of the current lack of experience, this application is not considered to satisfy the system constraints determined by this study.

TABLE 5.1

Tanker Self-Help Options

Type	Description
Inside Tanker Options	Liners/Temporary Patching Gelling/Solidifying Agents Oil Transfer Hydrostatic Loading Lightering Capability
Outside Tank Options	Bioremediation In situ Burning Chemical Dispersants Containment Booms Skimming Devices Sorbents
Other	Contingency Planning Structural/Design Changes (not within scope)

5.1.2 Gelling/Solidifying Agents

Gelling/Solidifying Agents are chemicals that significantly increase the viscosity of oil, creating a semi-solid material. The chemicals are typically comprised of polymerization catalysts and cross-linking substances (Schultze, 1991). Only select agents have been approved for use by Environment Canada and the U.S. Environmental Protection Agency (E.P.A.).

In theory, application of gelling/solidifying agents consist of adding an amount into a leaking cargo tank and mixing the agent with the oil. After a required minimum time for the agents to set, the oil becomes a solidified gel substance, preventing any further outflow from the tank.

There are a number of factors that have to be considered in the use of these agents as a self-help measure. The amount of agent required to solidify a large volume of oil is significant. Table 5.2 shows the weight percent of agent required to solidify an oil completely. These results are based on a standardized testing regime, where a solidifying agent was added to a standard oil with continuous mixing until the oil solidified (Schultze, 1991). The implications of these results is that a tanker would require a significantly large available storage capacity to provide enough agent for solidifying one or more cargo tanks.

The addition of solidifiers to oil requires thorough mixing for the process to work properly. Suggested methods for providing a minimum mixing energy are nozzle jets and air sparging (Ross, 1983). These systems also require extra pumping capacity. The apparatus for these mixing systems are not typically found on board ship, and any temporary installation would require ship crew and power.

Due to the minimum time required for the agents to set (approximately two hours) the use of solidifiers in situations where a large hole in the tank exists are limited. A high spill discharge rate would allow the oil to escape before the gelling process is complete.

In a case where solidifiers may be used effectively, in a cargo tank, the issue of removal and disposal must be addressed. The solidified oil would be difficult to pump out of the tank.

TABLE 5.2

Solidifier Test Results

Product Name	Percentage to Solidify
Rawflex	16
Norsorex	19
Oil Bond 100	33
Other Agents	44-200

Source: World Catalog of Oil Spill Response Products, 3rd Edition, 1991.

5.1.3 Internal Oil Transfer

The oil transfer option is based on utilizing designated storage or ballast tank space in an oil spill accident. For example, if the pumping capability and the designated storage space are available, cargo could be pumped out of the damaged tanks into designated storage space at a different location on the ship. This concept could apply to any cargo space that may get damaged or be available on board ship.

In some vessels, cargo and ballast tanks are cross connected, allowing pumping from the breached tank. If the oil and ballast piping system are not cross connected, then portable pumps and hoses placed onboard the vessel would allow oil transfer over the deck. This "over the top" method offers a potential advantage of positioning the suction in the oil volume, whereas the use of installed suction in a bilge tank can result in the transfer of oil and water.

The portable system for "over the top" transfer must consider such constraints as tank access, explosion-proof starting, and crew requirements for positioning and operating.

Fundamental to this option of tanker self-help are two criteria. The first is that there exists designated cargo space that would be available for loading damaged tank contents into. This would vary depending on vessel tank configuration and loading. It also requires that the vessel master has the information accessible pertaining to what areas may be available for extra storage, as well as the means to quickly calculate the change in vessel stability that would occur from transferring cargo throughout the vessel. The changing stability of the vessel is probably the most significant consideration for this self-help system.

The second criteria is that the pumping capability is onboard with the hoses and connections necessary for transferring cargo. Again some ships have this capability and others would require equipment for a temporary installation. Some vessels are equipped with valves, that have a seal between the cargo and ballast tanks. In the case of an emergency oil spill situation, a policy may be in place to allow transferring of cargo or ballast through these valves that are already in place, without incurring regulatory penalties.

The initial set up for oil transfer will have a minimum time requirement for the system start up and oil transfer. There would therefore be an amount of oil lost through the damaged tank until it could be pumped out.

Basic equipment requirements are pumps and hoses of sufficient capacity to move a designated volume of cargo in a specified time period, i.e. 50% of tank volume in 8 hours. Onboard ship crews and power would also need to be available or a self-contained pumping system would need to be provided.

5.1.4 Hydrostatic Loading

Hydrostatic loading is the option of loading cargo tanks with a volume of cargo at less than the tank's full capacity so that if a rupture were to occur, the hydrostatic pressure of oil out of the tank would be minimized. The way cargo is normally loaded is to essentially fill the tanks to capacity. This puts the level of oil at a higher elevation than the water level outside the vessel. When a tank hull is ruptured, the weight of the oil at a height above the waterline is a significant pressure forcing oil outflow (at a pressure proportional to the oil elevation).

If a vessel were to maintain cargo tanks loaded to the level of the waterline, a decrease in the quantity of oil transported would be a significant economic consideration. Estimates of 15-20% less cargo would result (NAS, 1989).

There are also stability considerations with lower oil levels in cargo tanks. The free oil surfaces cause stability changes as the vessel moves through the water, which can affect the structural integrity of the vessel. The motion of the vessel causes sloshing in the tanks, adding increased force to the tank walls. Additional inspection and possible strengthening of tank structures may be necessary.

In the case of a tank rupture, a certain amount of oil will still be lost, depending upon factors such as rupture location, tidal influences and sea state (NAS, 1989).

An alternative hydrostatic balance option is to selectively load certain tanks at the waterline level (those with the highest probability of damage in a grounding). This would allow a greater amount of cargo capacity, while still providing a measure of oil spill response.

Both options require no equipment or manpower services, and could be implemented immediately.

Another type of loading scheme involves loading oil on top of water in a storage tank. However, in the event of an accident, the suctioning devices typically located at the bottom of the tank, (if intact) could only suction a continuous flow of water, coming from the outside. This option was not investigated further.

5.2 Outside Tanker Options

5.2.1 Bioremediation

Bioremediation is the process whereby naturally occurring microorganisms are utilized to degrade organic matter, such as oil. The role of microorganisms in the breakdown of hydrocarbons has been studied for many years. Particularly in the 1970's, when the first major marine oil spills occurred, interest developed in using bacteria for oil pollution remediation. With the more recent advances in molecular biology, bioremediation is being looked at as an innovative environmental technology, and is in the process of becoming a fully commercialized product. The U.S. Environmental Protection Agency (EPA) has initiated the development of a committee to devise standardized testing methods for evaluating the applicability of bioremediation products that may be used on oil spills (NETAC, 1991). This information will provide spill response officials with data needed to determine what products may be effective in responding to oil spills.

The use of bioremediation as a tanker response in oil spill scenarios is very limited historically. Most experimentation to date has occurred in controlled conditions, usually on man-made oil slicks. One actual spill scenario was treated using bioremediation in June, 1990. An explosion on The Norwegian tanker "Mega Borg", resulted in the release of 4 million gallons of light Angolan crude oil, off the Texas coast in the Gulf of Mexico. This incident provided opportunity to test the effectiveness of bioremediation on marine oil spills. A 40 acre patch of slick was sprayed with a bacterial culture and a mixture of nutrients. A Coast Guard vessel (41 foot vessel) conducted the application using a mixing tank (55 gallon drum), pump, hose and nozzle. Equipment and treatment preparation took approximately one hour, and actual treatment of the slick was approximately 30 minutes. Conditions at the time of application were; sea surface covered in patches of thin oil, 3 to 4 foot swells, no chops; and light winds.

The results of this treatment were uncertain. An aerial reconnaissance 16 hours after treatment showed no signs of oil in the treatment area (ref: Mega Borg Oil Spill off the Texas Coast, 1990). However, wind and wave action, as well as skimmers working in the vicinity may have moved the oil or disrupted the treatment patch.

Further studies into the effectiveness of in situ bioremediation for oil spills is required before it could be approved by U.S. and Canadian regulatory authorities as a tanker self-help system for spills. There is also a need for research in the area of bioremediation working in cold (Canadian) waters.

Another study conducted in Port Aransas, Texas, utilized a control tank and a testing tank to determine microbial efficiency in reducing oil spilled in a marine environment. The results were promising, showing a 62% reduction in crude oil at the surface and a 99% reduction in the total water column over the 24 hour testing period (Texas General Land Office, 1990).

A bioremediation on-vessel response system is thought to require the following equipment: storage tanks, pumps, hoses and appropriate spray devices. It is anticipated that a minimum of two crew members would be required to assemble the equipment and operate the system. Ship's power would also be required for running pumps and spray equipment.

The necessary application equipment is not considered extensive and could occupy minimal space in storage. Several application units could be necessary if more flexibility and coverage is required.

The number of individual application units would be dependent on the size of vessel, size of spill and possible proximity of spill to the vessel. The quantity of stored microbe and nutrient mixture would be dependent on the expected spill volume.

5.2.2 Chemical Dispersants

The use of chemical dispersants, like bioremediation, does not actually contain or recover oil from a spill. Dispersants work to breakup surface oil and disperse it down into the water column at a rate faster than that which would occur naturally. The oil may then be oxidized, degraded, or weathered at an accelerated rate. Also, less damage occurs to waterfowl and other wildlife that are strongly affected by marine surface oil.

The type of situations where chemical dispersants could potentially be useful are:

- in open seas (rough waters) where standard mechanical methods are not effective; and
- when an oil slick is moving towards a zone of biological sensitivity.

Proper mixing of dispersant with the water surface is required for effectiveness. Wave action may provide enough mixing, otherwise some type of mechanical mixing would have to be introduced.

Dispersants work most efficiently when applied to unweathered oil slicks in relatively warm water. Typically, 48 hours is the limit at which an oil slick becomes too thin and weathered for a dispersant to be effective. Ratios of dispersant to oil vary depending on several characteristics such as type and viscosity of oil, type of dispersants and the amount of mixing. In general, a large volume of dispersant would have to be stored on the vessel to react with, and prove effective against, a typical marine oil spill.

A minimum requirement for dispersant effectiveness is that it be applied correctly to the oil slick, ie. volume and droplet size be controlled. Correct application is extremely difficult to control utilizing an onboard application system. Therefore, a dispersant system design which is based on a small vessel response, that can be lowered into the water from the tanker, would more successfully apply dispersant to the slick.

Before chemical dispersants can be applied to an oil slick, special permission from authorities must be obtained. Only after a careful evaluation of the area and the spill event, are dispersants granted approval.

Equipment requirements for this system are extensive and include:

- Small vessel with spray mounted system on board;
- Storage space onboard the small vessel for dispersant;
- Equipment onboard the tanker to deploy the small vessel into the water.

Similarly, manpower requirements are estimated to include:

- Three crew members to engage deployment mechanism off tanker;
- Four crew members onboard small vessel for navigating, engaging spray mount system and preparing the dispersant for application (i.e. hook up to tank);
- Three crew members onboard tanker to monitor and communicate to small vessel the direction and movement of the spill.

Utility requirements are:

- Power on tanker to operate deployment mechanism;
- Fuel supply should be on small vessel at all times for quick response.

The system would operate by manning the small vessel and then lowering it into the water. Crew members on the small vessel engage vessel mounted spray system and, in communication with the tanker, will commence the application of the dispersant. Constant attention to whether the conditions are appropriate for effectiveness should be given. Wave action, mixing energy, droplet size and oil thickness are all important components. It is most probable that dispersant would be deployed either from the ship or from a smaller vessel under less than ideal conditions, thereby achieving some benefit rather than none at all.

5.2.3 Containment Booms

Containment of oil once it has spilled into water involves the use of a barrier to confine oil in the immediate area. Containment booms are one of the most common equipment types used at the scene of an oil spill, not only to localize the spill but to aid in oil removal from the water.

The various features of a boom are; float, freeboard, skirts, tension member, and ballast (Schulze, 1991). Float is the element keeping the boom buoyant. Rougher sea states require that a higher buoyancy boom be used. The freeboard is the vertical height of a boom above the water line. This is to prevent oil from splashing over the top. The skirt is a continuous portion under the surface of the water, which acts to prevent the oil from passing underneath. The tension member serves by carrying the loads imposed on the boom such as towing, wind action and current. The ballast helps to maintain the booms vertical when balanced in the water.

All of these components are important to boom efficiency, and proper selection of boom type under various conditions are based on these components. Consequently, it is difficult to specify one boom configuration for all tanker self-help applications.

A vessel may typically carry a length of boom approximately 1.5 times the length of the vessel, or sufficiently long to encircle one side of the vessel. Deployment usually requires a towing mechanism. In the case of some booms, attention to inflatable components requires a more specific deployment system.

In the case of using a boom in a tanker self-help situation, a deployed boom usually functions to only contain the oil in a set location. The actual recovery of the oil requires other methods, such as skimming devices. The use of a boom alone is to limit oil spill spreading or to reduce the rate of spreading at or near the ship.

The deployment of a boom requires a workboat and numerous ship's crew. Also, sea conditions must be favourable to this type of operation in order to be both effectively and safely accomplished. For example, booms have proven to be effective in currents up to about 2 knots. There currently exists remotely controlled booms which might ease deployment from a tanker, but the other concern associated with containment booms still apply to this option.

Some of the most recent testing was carried out during the clean-up of the Exxon Valdez spill where a wide range of commercially available booms were utilized. The booms were categorized into the following six main types:

- high buoyancy internal foam flotation;
- medium buoyancy, externally attached flotation;
- external tension member;
- self-inflatable;
- pressure inflatable; and
- semi-permanent installation (Exxon, 1989).

Even though there was no deployment from the Valdez itself, a considerable base of knowledge pertaining to deployment, effectiveness and boom recovery was acquired and can be found in the report "Valdez Oil Spill Technology, 1989 Operations".

Another source of practical oil spill boom evaluation was conducted in 1987 (as a joint Canada-U.S. exercise off the coast of Newfoundland) by Environment Canada and the U.S. Minerals Management Service with additional support from the Canadian Coast Guard (Tennyson, Whittaker, 1987). The main objective of the experiment was to evaluate oil spill containment and recovery technologies in an offshore oil spill. Some of the main conclusions regarding containment booms were:

- the use of air support and small vessel support were essential in directing the placement of tow vessels and to advise on boom conditions for maximizing the efficiency of recovery operations.
- accurate measurements of the meteorological and sea conditions are necessary for analysis of the evaluations.
- manoeuvering of large containment booms necessitate the use of vessels with variable pitch propellers, bow thrusters and good seamanship.
- upwind collection proved impossible when winds approached 15 knots. This was consistent with other past observations.
- contained oil is lost if shipboard discharges such as cooling water impinge upon the slick during recovery operations.

(adapted from "The 1987 Newfoundland Oil Spill Recovery Experiment")

5.2.4 Skimming Devices

Skimmers are mechanical devices that pick up oil on top of water. There are numerous commercially available types of skimmers, defined by similar principles of operation.

Most skimmers have a range of viscosities in which they work best, so that an appropriate skimmer should be suited to certain oil types. Also, their performance and effectiveness are influenced by waves and currents. Skimmers typically work on the water/oil interface, which make them less effective under adverse sea conditions. High recovery rates can only be achieved when the sea conditions match the skimmer capabilities.

Most skimmers require a minimum oil slick thickness to ensure their performance. This is generally achieved by the use of containment booms.

A skimmer device that is designed to operate in open water conditions and deployed by a tanker crane and is hydraulically powered would be a probable configuration.

Consequently, the equipment requirements for a complete operating system include:

- deployment crane;
- commercially available skimmer;
- storage tank (for recovered oil/water);
- pump (hoses & connections); and

- oil/water separator.

Manpower requirements vary depending on skimmer operation used. Utility requirements are power for skimmer deployment crane; and power for pumps.

5.2.5 Sorbents

Sorbents used in oil spills are products that recover oil by adsorption and/or absorption processes. Sorbent materials are generally oleophilic and water repellant, so they can collect a larger amount of oil per unit weight of sorbent.

Synthetic sorbents are the most common type used in marine oil spills, and are made of polymeric materials such as polyurethane, polyethylene, polypropylene, nylon fibres and urea formaldehyde foam. They have high sorption capacities and can typically be used more than once (Schulze, 1991). They are commonly used in the form of a boom-shape, and are deployed in a similar manner.

Selection of a sorbent must consider a number of parameters to suit its use. Among these criteria are:

- material properties such as oleophilic tendency, rate of sorption, surface area, buoyancy and oil retention;
- ease of retrieval;
- disposal;
- storage; and
- cost. (Schulze, 1991)

Sorbents would have to be deployed with the use of a workboat. Manpower requirements are anticipated to be 3 crew members to man the workboat and 2 crew members to deploy the boat into the water and provide the sorbent and assist retrieval. In addition, services and utilities on board ship would include a storage area for spent sorbents and/or other facilities for safe disposal (incineration).

5.2.6 In situ Burning

The burning of oil in situ is a method of oil spill response that has been researched nationally and internationally. There are some very distinct advantages to burning in an oil spill accident, particularly in Canadian waters, where cold water temperatures, ice and remote area of transport favour this option. Burning has the potential to be the quickest method of removing oil, if the conditions for burning exist.

The burn response system would operate by first deploying a fire resistant boom (see Section 5.2.2 previously). The tow vessel(s) would proceed in a fashion through the slick and attempt to fill the capacity of the boom, which was 76 000 l - 114 000 l in the case of the Valdez burn (Spill Technology, 1990).

The boom is then closed and towed away from the tanker, making sure that a continuous bridge of oil does not reach back to the tanker. The loop of the boom is then ignited, burning the oil contained.

The equipment for such an application includes a fire resistant containment boom (about 300 m in length of a type suitable for most open sea states). Ideally, two vessels for towing the boom in a U-shaped configuration would be utilized, however, only one vessel might be available for use on the open seas. Also an igniting device (i.e. gelled fuel)is required to ignite the oil.

Manpower requirements for such an operation, done safely, are extensive:

- crew members to man two separate tow vessels (approximately three on each); and
- crew members on board the tanker to communicate with tow vessels and to deploy the vessels and boom off the tanker.

Also, it is necessary that sufficient utilities exist onboard ship to safely deploy and operate the two vessels and other apparatus.

Consideration must also be given to the adverse effects of the burning oil on water, particularly the resulting air emissions, and the potential for the burn to spread back to the tanker or to the tow vessels. There is also the remaining burnt oil residual that requires recovery and disposal.

Valuable insight on in situ burning was acquired from the test burn conducted as part of the Exxon Valdez spill (see Spill Technology, June 1990). Oil was collected using a fire boom on relatively calm seas, through scattered oil slicks. The slick was ignited using a small bag of gelled gasoline, and once ignited the boom was continuously towed. The estimated quantity of oil eliminated by burning was 57 000 to 114 000 l. The efficiency of the test burn was 98-99%, demonstrating a very high potential for mitigating an oil spill.

5.2.7 External Oil Transfer - Lightering Capability

The lightering of a tanker onto another vessel does not by definition fall into the category of self-help response. However, a vessel's ability to off load oil cargo in the event of a spill is largely dependent on equipment onboard the damaged tanker. In this respect, the responsibility lies with the tanker to provide as much of its own capability as possible, and will therefore be considered as a tanker self-help option.

Lightering is the process that involves removing cargo from a damaged tanker into offboard storage, usually another vessel or possibly a bladder. This minimizes the risk of further spillage and explosion potential on the vessel. Lightering can also be utilized to provide buoyancy for vessels that are grounded and are not able to move. The ability to relocate the ship may aid in mitigating certain environmental considerations. For example a vessel may run aground in a heavily used harbour area, or a zone of biological significance. The ability to relocate the vessel may decrease the amount of oil spilled in that particular area. In addition, being able to potentially move a grounded tanker may permit relocation prior to additional damage being inflicted due to tidal and weather forces.

Safety is of considerable importance in a lightering operation. In vessel-to-vessel transfer, the handling and maneuvering of the ships to allow for hose connections need to be done without colliding. The transfer from vessel-to-bladders run the risk of potential H_2S build-up, which was a concern with the Exxon Valdez clean-up (clean-up crew encountered H_2S within the bladder-bags utilized).

Basic equipment requirements for lightering include:

- fender protection on the tanker to allow accessability of a lightering vessel;

- lightering pumps and power unit; and

- hoses and connections.

In addition, ship's crew must also be available and familiar with operation of this equipment.

5.3 Other

5.3.1 Contingency Planning

Contingency planning is the "plan of action" that ship personnel can follow in the event of an accident causing oil leakage. Three guidelines for the development of an aboard response plan should be:

- realistic, practical, and easy to use;
- understood by all involved parties, both ashore and onboard; and
- evaluated, reviewed and updated regularly (IMO, 1991).

The plan should also account for language differences for vessel crews under various flags.

The main elements should include the following as quoted from "IMO Draft Guidelines for the Development of Shipboard Oil Spill Response Plans":

1. the procedure to be followed for a report to be made by the master or other persons having charge of the ship in the event of an oil pollution incident.

2. the list of authorities or persons to be contacted in the event of an oil pollution incident;

3. a detailed description of the steps to be taken immediately by persons on board to reduce or control discharge of oil following the incident; and

4. the procedure for coordination with national and local authorities in combating the pollution.

Some of the important points that fall into this framework are listed under the following sub-headings.

Damage Report

A damage report is essential for a ship master to assess the situation, and to make as much as possible, an informed decision. Particular points might include estimated structural damage, stability changes, fire hazard, tank damage and whether utilities are operational or not.

Communications

Both ship to shore and onboard communications are important to carry out appropriate tasks. Onshore response can then proceed with any assistance to the vessel, and crew members onboard can perform immediate ship duties.

Vessel Layout

Readily accessible layout plans of the vessel would allow more efficient and timely decision making. Piping, power systems, cargo tank and ballast tank connections, are some of the layout plans that should be immediately available. Certain oil spill responses are dependent upon this information, i.e. lightering operations.

Onboard Oil Spill Equipment List

The vessel master should have a list of the oil spill equipment onboard and its storage locations.

Training

The training of crew in emergency procedures and oil spill response is fundamental. Various people may be designated to carry out certain jobs, and their training in that area could prevent costly mistakes.

Contingency Plans should be vessel specific, so that the plan is modified to suit its situation. A basic format of information protocol could be created so each vessel and crew could follow it for devising an appropriate plan.

5.3.2 Structural Options

A number of options for oil spill prevention have been suggested through structural/design measures. Although the scope of this study does not include structural modifications, they warrant being mentioned as areas of potential research initiatives. Based on work carried out by the National Academy of Sciences (NAS) the following structural measures are being considered by the U.S. Coast Guard:

- Double Sides;
- Double Bottom;
- Protectively Located Segregated Ballast Tanks (PL/SBT);
- Resilient Membrane;
- Mid Deck Tanker - Independent or Convertible Tanks;
- Vacuum System - Mechanical or Passive; and
- Smaller Tanks (NAS, 1989).

These options would require major retrofitting to existing vessels, and redesign if implemented into new vessels.

6. EVALUATION

The evaluation of a tanker self-help system requires that a wide spectrum of variables be considered (Table 6.1, System Evaluation Table). Sea state, vessel type and size, type of oil and spill location are just some of the factors influencing the effectiveness of a self-help system.

Table 6.1 lists the system specifications (left hand column) of the tanker self-help system derived in Section 4.

The aforementioned tanker self-help systems identified in Section 5 are then summarized on Table 6.1 according to each of the system specifications.

Table 6.1 also attempts to measure both the effectiveness of the proposed self-help systems at recovery and/or prevention of spilling oil as well as the system's practicality for installation aboard tankers including safety and ease of operation. All of the options reviewed in Section 5 have potential effectiveness in certain oil spill situations. However the problem of equipment or system effectiveness lies in the unpredictable nature of tanker accidents, and having the appropriate oil spill technology that will be effective for that specific scenario.

As summarized from the marine oil-spill history (Section 3.3), emphasis for identifying a practical tanker self-help system has been placed on systems which can be used for marine oil spills of about 5000 tonnes and greater because they account for about 95% of the total spilled quantity from marine vessels during accidental releases. Similarly, vessel size of about 20 0000 DWT and larger are assumed to be typical of the size of vessels which could mount a self-help system because they account for about 84% of the marine oil spills of 5000 tonnes or greater.

It is improbable that a self-help technology could ever recover 100% of an oil spill for a variety of scenarios. Therefore, a system that does not recover 100% of the oil, yet is effective and practical in a wide range of conditions is suggested as a more realistic application of self-help technology.

Tanker self-help system effectiveness is then defined as a subjective measure of how well the system works for the amount of oil it recovers or prevents from spilling or spreading from the tanker. For example, if a system can be identified which is compact, very easy to operate, is very reliable, is safe to deploy, and recovers or prevents spreading of a high volume of oil then it is a positive and effective system. Yet, it may only address a small percentage of the total oil spilled from the tanker. However, because it is inherently an effective system, an opportunity arises to perhaps use many of these systems to address all the oil spilled.

Effectiveness then is one measure of system practicality. Another measure of practicality, which was used to evaluate the self-help systems summarized on Table 6.1, was the number of ship's crew which might be necessary to deploy the system and make it work safely. Those systems which required a number of crew members to be responsible for its operation were not favoured.

TABLE 6.1
SYSTEM EVALUATION

SYSTEM SPECIFICATIONS	LINERS / TEMPORARY PATCHING	SOLIDIFIERS	INTERNAL OIL TRANSFER	HYDROSTATIC LOADING
1. SHIP SERVICES REQUIREMENT (POWER & UTILITIES)	Power for deployment.	Power for cargo pumps.	Pumping capability to move cargo from one area to another. Valve and piping system may already be in place in some vessels.	None required.
2. STARTUP TIME	Approximately 30 minutes.	Approx. 30 minutes.	Immediate.	None.
3. SYSTEM RELIABILITY (PROVEN?)	Patch requires a proper seal is formed.	Requires that cargo leak is very small.	If equipment and capacity present, the system is reliable.	Reliable within its own limitations.
SHELF – LIFE (IF APPLICABLE)	Depends on material.	Indefinite.	Not applicable.	Not applicable.
4. DEPLOYMENT REQUIREMENTS – DEGREE OF INSTRUCTION	Highly specific instruction for implementing.	Mixing instructions.	Knowledge of extra storage capacity and piping connections.	Minimal deployment. Knowledge required by master for loading vessel accordingly.
– CREW MEMBERS REQUIRED	Several.	Two / tank minimum.	Minimal.	None.
– MECHANISM OF DEPLOYMENT	Typically requires highly trained divers.	Nozzle jet mixing.	Set up of hoses & pumps if no cross linking present. If so, then valves require opening.	No deployment required.
– EXISTING VESSEL OUTFIT	Equipment is not typical to existing vessel.	Must be built in.	System present in some vessels, others require pumps, connections and hoses.	Yes.
– ONBOARD COMMUNICATIONS	Yes.	Yes.	Yes.	Minimal.
5. PORTABILITY/SPACE SAVING	Yes, portable and space saving.	No. Large volume storage tank required.	Yes.	Not applicable.
6. TECHNICAL EFFICIENCY	System is very difficult to implement. Very risky for divers.	Only efficient if leak is small.	Yes. System consists of simply transferring oil, rather than a treatment process.	System is efficient provided that damage is sustained at the tank location with the lower oil loading.
7. SELF SUFFICIENCY FROM SHORELINE	No shoreside response required.	No shoreside response required.	Yes.	Yes.
8. ADAPTABILITY TO OIL TYPES	Adaptable to all oil types.	Adaptable to all oil types.	Yes, although pumping of high viscosity oil would take longer.	Yes.
9. FUNCTIONAL IN VARIOUS – WEATHER/TEMP.	A patch may work, but implementing in rough weather and cold is unlikely.	Onboard response, operational in all weather and sea state conditions.	Yes. Temperature may increase viscosity.	Yes.
– SEA STATE	Implementation in harsh sea state highly unlikely.		Yes.	Yes.
10. MOBILIZATION OF SYSTEM SHORE TO VESSEL	Yes.	No. Requires set up of mixing apparatus inside tanks.	System is either already on board, or is transportable to ship.	No mobilization required.
11. ADAPTABILITY FOR – RANGE OF SPILL LOCATIONS	May be a factor.	Not dependent on spill locations.	Yes.	Yes.
– SPILL DISCHARGE AND SPREAD RATES	Patch will be effective if it stays intact and seals properly.	If discharge rate is high due to formation of a large hole, use of solidifying agents prohibitive.	Yes, although high spill discharge will decrease amount of oil that may be transferred.	Spill discharge dependent on tank damage location. Tank would probably take water in after a period of time.
12. OTHER		Only some agents are acceptable to Environment Canada.	System is practical in terms of equipment requirements and cost.	Maybe impractical to load all cargo tanks this way. More feasible to load only certain tanks.

TABLE 6.1 (continued)
SYSTEM EVALUATION

SYSTEM SPECIFICATIONS	BIOREMEDIATION	CHEMICAL DISPERSANTS	CONTAINMENT BOOMS	SKIMMING DEVICES
1. SHIP SERVICES REQUIREMENT (POWER & UTILITIES)	Yes. Portable pumps require ship power.	Requires power for workboat deployment.	Deployment requires ship power for towing vessel.	Deployment requires ship power, may need extra pumping power depending on device.
2. STARTUP TIME	Approx. 30 minutes	Deployment and setup could begin immediately. Approval required.	Once tow vessel deployed, boom may be implemented on average = 400 m/hour	Placement of containment boom required before skimming.
3. SYSTEM RELIABILITY (RECOVERY)	Currently in experimental stage. Is not yet considered proven.	Efficiency depends on droplet size, mixing, and thickness of oil.	Booms are a reliable method of containment provided they are suited to sea conditions and positioned properly.	Skimmers are a reliable method of recovery, provided they are suited to the conditions.
SHELF – LIFE (IF APPLICABLE)	Approx. 1 year in dry form.	Indefinite. Chemical must have approval for use.	Variable.	Not applicable.
4. DEPLOYMENT REQUIREMENTS – DEGREE OF INSTRUCTION	Set up of pumping system, health & safety, mixing instructions	Deployment of spray vessel. Health & safety precautions required.	Boom positioning, accounting for wave and current action. Inflatable boom directions.	Proper sea conditions for operation, also connections for storage tanks and pumps.
– CREW MEMBERS REQUIRED	[illegible]	Minimum 3 members on vessel.	3 – 4 typically	1 – 2 typically
– MECHANISM OF DEPLOYMENT	Portable pump and spray	Crane system for deploying vessel.	Towing vessel.	Skimming vessel deployment or skimming unit deployment (crane).
– EXISTING VESSEL OUTFIT	Could be brought on vessel	Potentially.	Storage space for boom, and the deployment system for vessel.	Deployment system.
– ONBOARD COMMUNICATION	Yes.	Yes.	Yes.	Yes.
5. PORTABILITY/SPACE SAVING	Yes. Storage area needed for microbes, nutrients and pumps.	Spray vessel storage. Large dispersant/oil ratio needed. Required storage space.	Storage volume range from 0.02 – 0.10 cubic meters/meter.	Range in size from 4 – 10 square meters.
6. TECHNICAL EFFICIENCY	Not yet established.	Droplet size, mixing and salinity dependent. Efficiency of 20% – 70%, ratio of dispersant to oil important for effectiveness.	Most booms not yet proven in typical coastal and offshore wind and wave conditions.	Efficiency depends on sea state, viscosity, oil thickness and encounter rate. Portable units 40 – 50 cubic meters/hr.
7. SELF SUFFICIENCY FROM SHORELINE	Yes. If equipment and microbes are on vessel, no shoreside response needed.	No shoreside response required.	Yes.	Yes.
8. ADAPTABILITY TO OIL TYPES	Certain microbes will utilize a variety of hydrocarbons. Range needs further study.	Oil viscosity is important.	Yes.	Performance varies widely depending on viscosity of oil.
9. FUNCTIONAL IN VARIOUS – WEATHER/TEMP	Limited. Typically works better in warmer temp.'s. More testing required for cold water application. Exxon Valdez response utilized microbes with some success (on shoreline only).	Temperature affects viscosity of oil, making dispersant less effective. Weathering of oil affects dispersant action (weathering depends on climatic conditions).	Three types of functional design: calm water <0.3 m wave height harbor <1 m wave height offshore <2 m wave height	Temperature affects oil viscosity.
– SEA STATE	Adaptable in various sea states.	May aid in mixing energy required.	Range: smooth sea (SS1) to high sea (SS6). Offshore booms designed for SS4 – SS6.	Waves affect device by moving collecting mechanism away from oil. Currents causes oil to escape from mechanism.
10. MOBILIZATION OF SYSTEM SHORE TO VESSEL	Total system could be mobilized to vessel by air or another vessel.	Equipment would have to be loaded onto vessel beforehand.	Certain quantity could be mobilized to vessel.	Portable units could be mobilized to vessel.
11. ADAPTABILITY FOR – RANGE OF SPILL LOCATIONS	Not enough conclusive evidence.	Not as effective in fresh water. Prohibited use in waters containing major fish populations, breeding and migration.	Varies. Offshore boom suited for rough water may not work in high current area (proven in currents up to 2 knots).	Limited. Type of device should suit sea locations.
– SPILL DISCHARGE AND SPREAD RATES	Dependent on rate of deployment.	Thickness of oil is important to effectiveness.	Yes.	Most effective when oil is thick, and no debris or emulsion formation.
12. OTHER	Toxicity testing to date has shown most bioremediation effects on oil spills to be nontoxic when natural microorganisms are used.	Toxic to aquatic life and also increases the bioavailability of oil to marine life. Approval for use from regulatory agencies may delay use of dispersants in immediate situations.	Type of boom carried should be suited to typical sea state and location that vessel operates in. Usually used in conjunction with a skimming device.	Require the use of boom to contain oil for skimming to be effective. Also requires that sea state is calm for it to function.

TABLE 6.1 (continued)
SYSTEM EVALUATION

SYSTEM SPECIFICATIONS	SORBENTS	IN SITU BURNING	EXTERNAL OIL TRANSFER	CONTINGENCY PLANNING
1. SHIP SERVICES REQUIREMENT (POWER & UTILITIES)	Deployment may require ship services(crane).	Requires power for workboat deployment.	Power for pumping capability.	None.
2. STARTUP TIME	Immediately after deployment.	Containment of oil using boom Approx. 2 hours.	Requires the presence of another vessel.	Immediate.
3. SYSTEM RELIABILITY(PROVEN?)	Reliability is proven, depends on oil viscosity and type of sorbent material.	Burning time depends on oil thickness. Method is proven and efficient in proper conditions.	System is reliable.	System may increase reliability. Is proven in terms of human response.
SHELF - LIFE (IF APPLICABLE)	Indefinite when kept dry. Some affected by ultraviolet light.	Not applicable.	Not applicable.	Not applicable.
4. DEPLOYMENT REQUIREMENTS - DEGREE OF INSTRUCTION	Instructions for deploying into water and removal.	Trained crew members for containment and igniting the fire.	Knowledge of connection procedures and explosion hazard.	Knowledge of how plan operates and the ability to follow procedures.
- CREW MEMBERS REQUIRED	Minimum 2 – 3.	Minimum 6 / set up.	Minimal.	All crew should have some knowledge of procedures.
- MECHANISM OF DEPLOYMENT	Crane system.	Tow vessel deployment mechanism required (ie. ship crane).	Set up of hoses and connections.	Not applicable.
- EXISTING VESSEL OUTFIT	Maybe.	Potentially.	May be added on as additional equipment.	Yes.
- ONBOARD COMMUNICATION	Yes.	Yes.	Very important. Also requires ship to ship communication.	Yes.
5. PORTABILITY/SPACE SAVING	Approx. 8 – 20 cubic meters / 100 m length.	Tow vessel storage and deployment mechanism. Boom storage.	System is portable.	Not applicable.
6. TECHNICAL EFFICIENCY	Sorbency ratio ranges depending on viscosity: low viscosity 3 – 12 med viscosity 3 – 15 high viscosity 3 – 25	Quickest method of oil removal. Potentially 80 – 98% burn efficiency is achievable.	System is technically efficient.	System provides for more efficient response.
7. SELF SUFFICIENCY FROM SHORELINE	Yes. Removal may be difficult without help.	No shoreside response required.	No.	Yes, although plan would require that information be transferred to shore.
8. ADAPTABILITY TO OIL TYPES	Good, higher viscosity oils typically work best. Dependent on sorbent material.	Yes. As long as oil thickness and emulsion formation are minimal.	Yes.	Yes.
9. FUNCTIONAL IN VARIOUS - WEATHER/TEMP	Yes. Cold temperatures cause oil to become more viscous. High buoyancy sorbents may not work effectively in these conditions.	Functional in wide range of temperatures.	Functional in various weather. Temperatures may affect viscosity of oil, increasing pumping demands.	Yes.
- SEA STATE	Yes. Although retrieval of sorbent would be even more difficult in rough sea states.	Works best in calmer water (because of boom towing and emulsion formation).	May not be possible in rough seas.	Yes.
10. MOBILIZATION OF SYSTEM SHORE TO VESSEL	Yes.	Equipment would have to be loaded onto tanker beforehand.	Could transport pumps and hoses to ships.	Plan should be onboard in locations that all officials and crew are aware of.
11. ADAPTABILITY FOR - RANGE OF SPILL LOCATIONS	Highly adaptable to spill locations. May be used in areas where other methods not feasible.	Preferable in open seas instead of closed in areas (harbours). May be useful in ice conditions.	Yes.	Yes.
- SPILL DISCHARGE AND SPREAD RATES	Yes.	Requires minimum oil thickness for combustion (reason for boom containment).	Not necessarily applied to leaking tank, rather to decrease further risk.	Yes, plan should account for various spill rates.
12. OTHER	Sorbents are most economically feasible on small spills. Retrieval of sorbent from water is extremely difficult, especially in open waters.	Crew safety is of prime concern. Air emissions are of major concern.	System is not independent of shoreline response.	System should include a training component for all involved.

A third measure of system practicality was system completeness which incorporated such parameters as the extent to which the system was commercially available, didn't require further development or technology, was safe to operate, and didn't impose a risk to the ship or ship's crew by requiring complex installation or operations.

Evaluating the self-help systems based on practicality provides a recommendation towards a more likely system for use onboard a tanker. The system specifications in Section 4 derived from the marine oil spill historical data, identify as the most important considerations, system practicality and effectiveness. The "candidate" self-help options as shown on Table 6.1 are then evaluated against these system specifications.

Part two of the evaluation includes an application of recommended system options to historical Canadian marine oil spills. The tanker self-help systems are assessed as to their perceived effectiveness had they been available in the given accident.

Section 6 concludes with an assessment of the legislation which might be utilized to implement tanker self-help systems.

6.1 Inside Tanker Options

6.1.1 Liners/Temporary Patches

Liners are not considered a practical self-help system because they require structural change to the ship's holds. However, since liners are essentially a design modification to the vessel, they do not conform to the definition for the purpose of this study, of a tanker self-help system.

A temporary patch system could, in some accident scenarios, provide an effective means of oil containment. However, temporary patching for a tanker cannot currently be considered a reliable and proven system of self-help.

6.1.2 Gelling/Solidifying Agents

The use of gelling/solidifying agents has merit as a potential form of oil containment in a variety of applications. However, as a tanker self-help measure, it is extremely limited. The greatest difficulty with the use of these agents for tanker self-help is the amount of required agent and storage space necessary. The ratio of oil to agent can be as high as 2:1, which would require the vessel to carry an impractical amount.

The necessary mixing of the agent would have to be provided by special apparatus onboard the vessel. The mixing procedure could also require that an inordinate amount of fluid would need to be mixed; either agent, oil or both.

The time delay required for the solidifier (1/2 hour - 2 hours) to act, combined with the outflow of oil from the leak necessitates that the agent would only be effective if the hole was very small. An oil spill accident over 5000 tonnes, typically results in damage to the tank hold which is usually substantial. The use of gelling/solidifying agents are therefore not considered feasible as an effective oil containment measure.

In a situation where oil is successfully gelled or solidified, the removal of oil from the tanks may also pose a challenge.

6.1.3 Internal Oil Transfer

The option of transferring oil to areas on the ship that are secure, such as ballast tanks, may be one of the more practical self-help systems available. For vessels that are already outfitted with the transfer piping, no further adaptations may be required. Provided ship services are available, oil from the breached tanks may be transferred in this instance to ballast tanks in the event of an emergency. For vessels with segregated ballast tanks, power or hydaulics must be available on-deck to drive the pump. If services are not available, then the portable pump must be equipped with an explosion-proof diesel as a part of the temporary package. The diesel, pump and hoses to allow internal transfer of oil require approximately three standard containers. This may make transfer of this equipment to the ship, and its storage aboard, somewhat difficult.

Oil transfer requires that the ships master and officers have an accurate damage report, and are able to determine effects of oil transfer on ship stability, in a relatively short period of time. The onboard communications system between the crew and the master are essential for activating the response. Because heavy losses can occur very rapidly when a tank is ruptured, the system would have to be deployed as fast as possible. Even then, there may already have been substantial outflow before the system could transfer the oil. Safety concerns include the possible formation of explosive gases in the ballast tanks or other areas of the ship. Ballast tanks are typically not inerted, so there is a danger of explosion.

The system provides a degree of practicality based on its relatively simple/low equipment requirements, and the ease of deployment in terms of degree of instruction to crew members who should already be familiar with the pumps and piping on the ship.

6.1.4 Hydrostatic Loading

The system of hydrostatic loading for self-help response has merit in terms of practicality as well as effectiveness. The system requires no deployment procedures and equipment, and is effective immediately when a spill event occurs. Regardless of the type of accident, the hydrostatic pressure in the tank is lower, resulting in less oil outflow. All configurations of hydrostatic loading are considered equal for the purposes of this report.

Special concern is required for stability changes that lower tank levels induce, as well as the effect of the free-surface areas on stability. Extra stability equipment may be required to monitor these effects (NSA, 1989).

Other implications of this system are of an economic nature. Vessels carrying reduced cargo loads may be subject to penalties to compensate for smaller cargoes. The reduced amount of cargo is a factor dependent on the ship configuration and size. The alternative option is to utilize hydrostatic loading in the tanks where damage is most likely to occur (ie, front wing Tanks). This would enable a larger percentage of cargo to be carried, yet still provide a measure of oil spill protection.

Either way, a decision in terms of economic tank loading and ship policy would have to be addressed for this system to be utilized. However, because of the relative ease of technical system implementation, this concept should be pursued further.

6.2 Outside Tanker Options

6.2.1 Bioremediation

Bacteria require certain environmental conditions for efficient metabolism, not all of which are necessarily present in each oil spill situation. The Mega Borg incident occurred in water that had a fairly high temperature (86°F), which is conducive to higher reaction rates in bacteria. For spills in Canadian waters, where the water temperature is much colder than this, bacterial action would occur at a much slower rate. Some of the other environmental conditions affecting bioremediation of marine oil spills are:

- salinity;
- pH;
- surface area; and
- nutrient transport.

Different strains of bacteria have different degrading properties based on these conditions, as well as the type of oil they are applied to.

Bioremediation technologies do not work by containing or recovering oil from an oil spill. It is at best, a method to mitigate the effects of an oil slick on wildlife, fish, shellfish and marine habitats such as beaches and estuaries. In spill scenarios where other, more mechanical oil spill technologies are impractical (such as rough sea conditions and poor weather) bioremediation may provide a solution to at least decrease the environmental damage that an untreated oil slick would cause.

The versatility of using bioremediation in poor weather and sea conditions is a positive aspect of this technology. But more research and development are necessary to test the effectiveness and reliability in actual oil spill situations. Also, further testing in cold weather climates and various sea conditions are required, although preliminary experimentation looks promising. Analyses of the toxicity of bioremediation on marine life and possible damage to the nutrient balance are areas still being researched.

The deployment of the system requires crew members dedicated to this task, which is always a limiting factor in a spill event.

6.2.2 Chemical Dispersants

There is much controversy surrounding the use of dispersants, and their use is fairly restricted in Canadian waters. Many of the chemical agents used are toxic to marine life, although they are much less toxic today than chemicals used in the past. The oil spill from the Torrey Canyon was treated with chemical dispersants which were quite hazardous to the marine environment, compounding the detrimental effect of the oil spill. Even as the oil itself dissipates down through the water column, the potential is high that a greater number of organisms will be adversely affected. The long term biological and toxicological effects of oil once it has been dispersed are not yet fully understood.

Other negative aspects of chemical dispersants are:

- not practical to apply from vessel because of specific droplet size requirement;
- not practical to deploy due to manpower requirements and extra-vessel use;
- expensive because of high dispersant to oil ratio;
- requires "good wave action" to achieve proper mixing;
- approval for application takes time; and
- not effective in thick oil (probable conditions for this study's application).

As a result, chemical dispersants are not considered currently to be a viable tanker self-help system.

6.2.3 Containment Booms

The use of booms as a self-help response has some limitations. Deployment of booms from a tanker can be very difficult for a number of reasons. Booms are heavy and cumbersome for crew to position and to remove without extensive lifting equipment. The amount of freeboard on a tanker makes deployment extremely difficult. A workboat is required to take the boom out, and the boom must be suited to the conditions present. For example, calm water booms are not effective in rough sea conditions. Also, the amount of boom required to contain a large spill is too great to be practically carried on a tanker and therefore, onboard boom is generally used for small spills only. Another consideration is that the rate of spreading from an oil spill can be as high as 20-30 m/sec., making it extremely difficult for a boom deployed from a vessel to do any good. Also, crew members are not normally trained or available for boom deployment.

There are a wide variety of commercially available products, suited for different locations and sea states. Booms are usually used in conjunction with skimming devices for oil recovery.

It is practical for a vessel to carry some containment booms for smaller spills. However, it should not be emphasized as a highly effective method alone for large tanker spills.

6.2.4 Skimming Devices

Skimmers are more commonly associated with shoreline response systems, rather than as a tanker self-help measure. While high efficiencies of volume recovery are achievable, specific circumstances such as sea state, weather, current and oil viscosity greatly affect the skimmer performance. Also, containment of oil using booms is commonly required to provide a minimum oil thickness and recovery rate. Therefore, this system requires two responses for its application.

A variety of skimmer types were utilized in the Exxon Valdez oil spill, which were flown in after the accident. In some instances the use of oil/water separators aided in reducing the amount of required recovered oil/water storage space. The Valdez Oil Spill Technology Report (Exxon, 1989) evaluated several skimmers for their effectiveness. While most deteriorated in performance as the oil weathered some of the skimmers were not effective at all because of the oil viscosities.

For a skimmer to be a part of a tanker self-help system, it would have to be able to work in open water conditions, with various oil viscosities. Skimmers of an onboard tanker size are not available to handle these conditions. Again, the deployment of systems such as this from a tanker are impractical.

6.2.5 Sorbents

Sorbents are generally used in conjunction with other response mechanisms in an oil spill situation. They require deployment in a similar method to containment booms, where crew members would have to go out into a workboat. Again this is a highly undesirable situation in a spill event. The removal of sorbents from open waters is difficult and would be considerably worse in rough sea state conditions. This reason alone is often why sorbents are ruled out for tanker self-help use (Schultze, 1991).

For a tanker to carry sorbent onboard as self-help measure, would require a large storage volume; beyond what is feasible in terms of space. Sorbents are far more feasible in situations such as small spills or in hard to reach areas (i.e. piers).

6.2.6 In situ Burning

Burning is not a containment/recovery response. Rather, it is a one step disposal method. Other systems of oil spill response may require treatment, separation and then final disposal, imposing logistical problems as well as additional costs. The equipment requirement for in situ burning is much less than what is normally used in other, more mechanical spill responses, making it a more favourable option in that respect.

The success of burning an oil slick depends on certain conditions that must be present. These are:

- oil must be of a minimum thickness for it to burn;
- oil must contain a sufficient percentage of its light flammable components;
- oil must not be heavily emulsified; and
- an effective ignition source must be readily available. (Melville Shipping, 1991).

One of the biggest drawbacks of burning oil is the release of atmospheric emissions. This includes the smoke plume, particulate matter precipitating from the smoke plume, combustion gases, unburned hydrocarbons and residue left at the burning pool site (Environment Canada, December, 1990). Public response to the burning of oil is generally quite negative. The feasibility of deploying a workboat(s) and crew to contain a slick and ignite it is very low. There is also a major safety consideration to be concerned about; igniting oil beyond the boom and/or the ship.

6.2.7 External Oil Transfer - Lightering Capability

Lightering capability is recommended as a tanker self-help system. Although the process involves an oil storage component; based on the availability of another vessel, the tanker should be equipped to make use of this option. In situations where tankers have run aground in more remote areas, lightering capability for a tanker is very important. The Exxon Valdez was equipped with its own lightering pumps, and was able to transfer 80% of its cargo to another tanker. This also enabled the Valdez to become ungrounded from the reef.

Part of the lightering exercise involves a knowledge of the vessel's piping system, which is an essential requirement for vessel connections. The grounding of the "Rio Orinoco" on Anticosti Island, Quebec in late 1990 was a situation where crew were not completely knowledgeable of the piping system, and therefore could not have proceeded with a lightering operation even if the opportunity had been available.

Special transfer precautions should be practised if the tanker has no inert gas generation capability (due to the accident or other use). Significant explosion danger warrant the extra precautions.

The equipment requirements for lightering are fairly minimal, and the degree of ease in the deploying system is practical and cost effective as a means of self-help. Specific requirements for capacity and power would have to be determined for each vessel type.

6.3 Other

6.3.1 Contingency Planning

The development of an oil spill contingency response plan is essential to tanker self-help in two ways. First, it provides a protocol for ship masters and crew as to what they can immediately do to mitigate an accident event. Secondly, a contingency plan serves to enhance any other number of oil spill responses by providing pertinent details of the vessel and environmental conditions.

A spill event is ultimately a stressful and trying situation for the ship's officials and crew. Prioritizing the required action, needs quality information and good judgement. A contingency plan that is well thought out and modified to a specific vessel is a tool that could provide information necessary for a manageable sequence of events aiding in oil spill response.

Without a plan, valuable time may be lost in the organizing and arranging of tasks and information. In a large oil spill, severe damage may occur very quickly, so any time saved may benefit the situation significantly.

6.4 Preliminary Assessment of Systems

Any analysis of tanker self-help systems is subjective due to an inability to quantify all aspects of design and operation. However, based upon the results of the foregoing analysis a measure of self-help system practicality as measured against the system specifications has been attempted. The results of this subjective analysis are summarized in Table 6.2; Preliminary System Assessment.

The preliminary results suggest that only the following systems should receive further consideration as potential self-help systems.

- Internal Oil Transfer;
- Hydrostatic Loading;
- Booms and Skimmers (limited application);
- External Oil Transfer/Lightening; and
- Contingency Planning;

These five systems are next evaluated against actual oil spill circumstances reported in Canadian waters.

TABLE 6.2

Preliminary System Assessment

System	Overall Practicality
Liner/Temporary Patching	System has very limited practicality and is not recommended as a self-help method due to structural changes necessary to implement effectively.
Solidifiers	System not practical due to volume of solidifier required and time for implementation is too great relative to spill release rate.
Internal Oil Transfer	System is practical because of low equipment requirements and familiarity with similar equipment onboard ship. Specific system specifications need to be resolved such as pump rate, power availability, and service requirements prior to recommending a standard system. Available onboard tanker space, system loading/unloading and unavailable storage configurations must also be resolved.
Hydrostatic Loading	System is practical provided the loss of cargo penalty can be accommodated (as great as 20%). Specific details as to appropriate tank configurations and fill volumes need to be resolved as well as cost factors. Note: this system could be used in conjunction with the previous system, internal oil transfer, according to some pre-determined level of availability agreed to by all affected parties.
Bioremediation	Deployment which requires the use of another vessel is impractical and probably not safe for ships crews at the time of the incident. Many technical unknowns make this system more suitable to shore mounted spill response at this point in its development.
Chemical Dispersants	Deployment which requires the use of another vessel is impractical and probably not safe for ships crew at the time of the incident. Technical unknowns exist on behalf of the scientific and regulatory specialists which question the effectiveness of dispersants. A shore mounted spill response is better suited.
Containment Booms	The logistics of deployment of booms including lowering them from the deck of a ship to the water, and maneuvering them into place to provide any containment does not make them suitable as a self-help system. However, as they are proven technology, limited application may be possible.
Skimming Devices	Skimming devices are not considered practical because they are difficult to deploy and require the use of a boom to be effective (see above).
Sorbents	Sorbents require significant onboard storage and are not considered to be deployable or retrievable in a practical manner.
In Situ Burning	The logistical requirements for both booming and containment of the oil and providing for safe burning conditions do not make this system practical as a self-help system.
External Oil Transfer	The capability to be able to provide lightering capability onboard ship is considered a practical self-help system. When any opportunity is available to safely transfer oil cargo to another vessel it should be possible given that the equipment is onboard and easily operable. System specifications would need to be defined to provide standardization of this capability. Note: as with internal oil transfer and hydrostatic loading this capability could be incorporated as a component of overall ships self-help capability.
Contingency Planning	This capability is considered both desirable, practical and necessary as a starting point for ship's crew training and emergency response preparedness, irrespective of any self-help system being utilized.
Other	Other systems are possibly available which could be evaluated in a similar manner. However, technical or logistical constraints have not made them obvious at the time of this report.

6.5 Assessment of Candidate System Performance Based Upon Selected Known Incident Conditions

The candidate tanker self-help systems were reviewed in the previous section based upon the generic system objectives, requirements and constraints. These candidate systems might now be evaluated on the basis of how they might have performed given the conditions which prevailed during known marine pollution incidents.

Since this study entailed the evaluation of tanker self-help systems for vessels operating in Canadian waters, it is appropriate to review system performance for the conditions which existed during previous marine spills in or near Canadian waters. The Tanker Safety Board of Canada provided information concerning marine occurrences involving major pollution incidents in or near Canadian waters since 1975, the date at which their computer data base commences. Table 6.3 presents these incidents from the Tanker Safety Board data base. Further particulars of these events were earlier provided in Table 3.4 of this report. Appendix D, Marine Casualty Investigations, has been included to present examples of the available accident records.

In addition, Table 6.3 includes a number of incidents which did not result in major pollution but nonetheless the spill was of sufficient magnitude to be included within the Minerals Management Services data base. In these instances, the Tanker Safety Board was able to provide investigative reports for these incidents. The incidents involving the vessels "Golden Robin", "Mekhanik Tarasov", "Irving Eskimo", and "Arctic Link" represent this category.

Two incidents, included within Table 3.4, were excluded from Table 6.3. In these instances, the vessel name was unknown and there was so little information available pertaining to conditions at the time of the incident that inclusion of these events in Table 6.3 would have been meaningless.

Table 6.3 identifies the particulars of the pollution incident and conditions at the time, which might possibly affect the performance of the tanker self-help system. The categories of "type of casualty" and "vessel damage" allow an assessment of the stability/safety of the vessel and the potential availability of the crew to deploy a tanker self-help system immediately following the incident. The category "spill description" allows an assessment of the candidate systems ability to be effective for the oil type and quantity. The category "locale" allows an assessment of the candidate system for the generic location of the incident. The categories of "sea state", "wind", "visibility" and "weather" allow an assessment of the candidate systems possible performance within these environmental conditions.

The data received from the Tanker Safety Board included very little information describing the spill, such as rate of outflow from the vessel and rate of spread.

The performance of the candidate systems within the prevailing conditions at the time of the incident of Table 6.3 was then assessed. The results of this evaluation are provided in Table 6.4.

TABLE 6.3

Particulars of Selected Marine Pollution Incidents In or Near Canadian Waters

Date	Vessel Name	Type of Casualty	Spill Description	Vessel Damage	Locale	Sea State	Wind (kts)	Visibility (miles)	Weather
30/09/1974	Golden Robin	Grounding	Bunker C	Bottom damage to three tanks	Inshore	N/A	Light	Clear	Overcast
23/06/1976	Hepco 140 (Barge)	Grounding	Bunker C	Considerable bottom damage	Inshore	Calm	N/A	Fog, 7	-
15/03/1979	Kurdistan	Contact with ice	Crude	Extensive forward damage; vessel sank	Offshore	Rough	30	Fog	Rain
25/12/1979	Lee Wang Zin	Capsized	Diesel	Capsized following bottom damage	Offshore	Rough	35	5	Overcast
02/02/1981	Le Cedre No. 1 (formerly "Arthur Simard")	Grounding	Diesel	Extensive bottom damage	Inland Waterway	Heavy ice cover	20	0.5	Moderate snow
16/02/1982	Mekhanik Tarasov	Capsize	Bunker C	Total loss	Offshore	Very heavy	50	N/A	Snow
27/06/1982	Imperial Acadia	Grounding	Diesel	Extensive bottom damage	Harbour area	Moderate	10	Darkness	Fine
10/01/1983	Star Luzon	Hull damage (cause not reported)	Bunker C	Puncture in fuel tank	Harbour	N/A	N/A	N/A	N/A
06/12/1983	Irving Eskimo	Contact with Bottom	Bunker C	Bottom damage	Inland	N/A	Light	0.5	Snow
17/12/1983	Unisol	Grounding	Diesel	Extensive bottom damage resulting in constructive total loss	Harbour	Very heavy	45	5	Heavy rain
29/02/1984	Bute No. 3 (Barge)	Grounding	Diesel	Extensive bottom damage	Inshore	Rough	Gusts, 50	0.25	Rain
01/07/1984	Arctic Link	Grounding	Diesel, Bunker C	Bottom damage total loss	Inshore	Calm	5	10	<5°C
09/09/1985	Dolphin Mary No. 16	Fire	Diesel	Total loss	Harbour	N/A	N/A	10	N/A
03/12/1985	McAsphalt 401 (Formerly Point Levy)	Grounding	Bunker C	Bottom damage	Inland	Very rough	45	10	Rain and snow
21/12/1985	Arco Anchorage	Grounding	Crude	Minor	Harbour	N/A	N/A	N/A	N/A

TABLE 6.3 (Cont'd)

Particulars of Selected Marine Pollution
Incidents in or Near Canadian Waters

Date	Vessel Name	Type of Casualty	Spill Description	Vessel Damage	Locale	Sea State	Wind (Kts)	Visibility (miles)	Weather
30/08/1986	Radium 332	Grounding	Diesel	Extensive bottom	Inland	Rough	55	N/A	N/A
09/01/1987	Stuyvesant	Hull fracture	Crude	Holed bow and bottom	Offshore	Very heavy	47	5	N/A
04/10/1987	Stuyvesant	Hull fracture	Crude	N/A	Offshore	N/A	N/A	N/A	N/A
22/04/1988	Athenian Venture	Fire	Gasoline	Total loss	Offshore	N/A	35	2	Fine
08/05/1988	Czantoria	Striking	Crude	Hole in port	Harbour	Calm	5	10	Fine
10/11/1988	Odyssey	Fire	Crude	Total loss	Offshore	Heavy	43	6	Showers
24/03/1989	Exxon Valdez	Grounding	Crude	Extensive bottom damage	Inshore	Calm	N/A	N/A	Fine
26/03/1989	Lake Anne	Striking	Chemical	Holed shipside	Lock	N/A	3	5	Fine
15/11/1990	Berge Broker	Weather damage	Crude	Considerable hull damage	Offshore	Very heavy	56	N/A	N/A

TABLE 6.4

Evaluation of Candidate Systems Based on Selected Marine Oil Spills In or Near Canadian Waters

Date	Vessel Name	Internal Oil Transfer	Hydrostatic Loading	Boom & Skimmers	External Oil Transfer-Lightering	Contingency Planning
30/08/1974	Golden Robin	*	*	*	*	*
23/06/1976	Nepco 140 (Barge)	*	*	No	*	*
15/03/1979	Kurdistan	No	No	No	*	*
25/12/1979	Lee Wang Zin	No	No	No	*	*
02/02/1981	Le Cedre No. 1 (Formerly "Arthur Simard")	*	*	No	*	*
16/02/1982	Mekhanik Tarasov	N/A	N/A	N/A	N/A	N/A
27/08/1982	Imperial Acadia	*	*	*	*	*
18/01/1983	Star Luzon	*	*	*	*	*
09/12/1983	Irving Robins	*	*	*	*	*
07/12/1983	Unisol	*	*	No	*	*
29/02/1984	Bute No. 3 (Barge)	*	*	No	*	*
01/07/1984	Arctic Link	*	*	*	*	*
03/09/1985	Daishin Maru No. 18	No	No	No	No	*
03/12/1985	McAsphalt 401 (Formerly Point Levy)	*	*	No	*	*
21/12/1985	Arco Anchorage	*	*	*	*	*
20/08/1986	Radium 332	*	*	No	*	*
26/01/1987	Stuyvesant	*	*	No	*	*
04/10/1987	Stuyvesant	*	*	N/A	*	*
25/04/1988	Athenian Venture	No	No	No	No	No
08/05/1988	Czantoria	*	*	*	*	*
10/11/1988	Odyssey	No	No	No	No	*
24/03/1989	Exxon Valdez	*	*	*	*	*
20/03/1989	Lake Anne	N/A	N/A	N/A	N/A	N/A
13/11/1988	Barge Bruker	*	*	No	*	*
		* Yes is based on ship stability, crew and space availability	* Yes is based on location of damage	* Yes is based on good weather and sea state conditions and crew availability	* Yes is based on ship stability, crew and space availability	* Yes is based on whether a contingency plan could have influenced the outcome of the event

A brief review of these subjective evaluations follows:

- Golden Robin - a vessel grounding in inland waters in good weather where ship safety was likely never in question; all systems would have been beneficial.
- Nepco 140 - a surge caused by high currents caused the barge to run aground in calm water. Since vessel stability was likely never in question, all systems would have been beneficial.
- Kurdistan - vessel "broke apart" and sank following contact with ice; systems which maintained oil onboard would not have been beneficial; external lightering such as into an onboard bag or bladder would have been beneficial since there appeared to be ample time for the crew to react; contingency planning might have reduced time for support equipment to arrive on scene; seas were too rough for deployment of booms.
- Lee Wang Zin - vessel eventually sunk; for the reasons described above, systems which maintained oil onboard would have been of limited benefit; seas were too rough for deployment of booms.
- Le Cedre No. 1 - vessel stable following grounding; therefore crew presumably willing and available to deploy self-help system; presence of ice prevents deployment of booms.
- Mekhanik Tarasov - this roll-on/roll-off vessel sank in very heavy seas; vessel crew always faced with greater priority of ship safety.
- Imperial Acadia - vessel grounded in fine weather and calm seas; since ship stability likely never in question, tanker self-help systems could have been deployed and all would have been beneficial.
- Star Luzon - as per "Imperial Acadia".
- Irving Eskimo - as per "Imperial Acadia".
- Unisol - vessel grounded in very heavy seas, tanker self-help systems would have been beneficial; sea states would have prevented deployment of booms.
- Bute No. 3 - as per "Unisol".
- Arctic Link - vessel grounded in calm seas; crew presumably available to deploy tanker self-help; all systems deemed beneficial.
- Daishin Maru No. 16 - vessel total loss following fire; crew presumably always had greater concern of ship safety; contingency planning may have accelerated response.
- McAsphalt 401 - as per "Unisol".
- Arco Anchorage - as per "Arctic Link".

- Radium 352 - as per "Unisol".
- Stuyvesant - as per "Unisol".
- Athenian Venture - as per "Daishin Maru No. 16".
- Coantoria - as per "Arctic Link".
- Odyssey - as per "Daishin Maru No. 16".
- Exxon Valdez - as per "Arctic Link".
- Lake Anne - incident occurred in a lock in the state of New York; as a result of the peculiarities of this incident, it was excluded from our evaluation.
- Berge Broker - as per "Unisol".

The results of this analysis suggest that the most practical tanker self-help systems are:

- internal oil transfer,
- hydrostatic loading,
- external oil lightering, and
- contingency planning.

The evaluation also identifies that in over 50% of the incidents, conditions of sea state and ice would have prevented the deployment and effectiveness of containment booms and skimmers. For this reason, as well as those identified previously, booms and skimmers are not considered to be a "stand-alone" practical tanker self-help system.

The question of deployment, specifically the added risk to crew of transferring a boom from the ship's deck and positioning it effectively to entrap oil, appears to offset the benefits of using this otherwise proven technology.

A consideration of implementation of these systems given current Canadian Legislation is undertaken in the next section.

6.6 Legislation for the Introduction of Tanker Self-Help Regulations

The safe operation of marine vessels in Canadian inland waters and territorial seas is governed by those international conventions adopted by Canada as well as domestic legislation. The introduction of legislation providing for a mandatory tanker self-help system might possibly be incorporated within these existing covenants and acts.

Internationally, much of the legislation governing the safe operation of marine vessels has been introduced by the International Maritime Organization (IMO).

IMO has created many internationally recognized conventions governing the operation of ships including the 1974 International Convention for the Safety of

Life at Sea which served to reduce marine pollution at sea by enhancing vessel safety and the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL) which served, along with a protocol to this convention introduced in 1978, to lessen marine oil pollution by establishing standards for tanker equipment and operating practices.

IMO is currently preparing further legislation governing the operation of tankers. This is the International Convention on Oil Pollution Preparedness, Response and Co-Operation (OPRC) which, among other provisions, require ships of countries signatories to the Convention to have onboard an oil spill pollution emergency plan. This Convention is expected to come into force soon after ratificaton by countries representing at least 50% of the world's tonnage. Thus far, 90 countries, including Canada, have signed the Final Act signifying agreement with the provisions of the Convention.

The Marine Environment Protection Committee of IMO has recently adopted amendments to MARPOL which require the provision onboard tankers of a "Shipboard Oil Spill Response Plan". This amendment requires every oil tanker of 150 GRT (gross registered tonnes) and above to carry onboard an oil spill response plan approved by IMO. This amendment will be brought into force 22 months after approval by two-thirds of MARPOL's signatory countries representing at least 50% of the world's merchant fleet. MARPOL countries however are not obligated to adhere to this convention. Thus far, 90 countries, including Canada, have signed the Final Act signifying agreement with the provisions of the Convention.

As described, revision to their existing Conventions concerning tanker self-help appears to focus upon having onboard appropriate plans and/or procedures governing reactions in the event of a spill. It is possible to consider implementing further tanker self-help systems through these international conventions but this is a lengthy procedure which requires ratification by many countries.

Vessel operations in Canadian inland waters and territorial seas are governed by two principal forces of legislation, the Canada Shipping Act and the Arctic Waters Pollution Prevention Act (AWPPA). The Canada Shipping Act regulates all vessels within Canadian waters and territorial seas. An amendment or annex to the Canada Shipping Act would be appropriate for the introduction of regulations pertaining to tanker self-help since it influences all tankers/vessels operating in Canada.

The AWPPA regulates vessels operating in Canadian waters north of 60° latitude. An amendment or annex to the AWPPA would be appropriate to introduce regulations pertaining to tanker self-help which may be particular to tankers operating in Canadian Arctic waters.

7. SYSTEM DESIGN AND IMPLEMENTATION

The result of the evaluation of various self-help options (Section 6) concluded that four alternatives were preferred and should be evaluated further. These options were:

- internal oil transfer;
- hydrostatic loading;
- external oil lightering; and
- contingency planning.

This conclusion was reached based upon first; a measure of system effectiveness and practicality defined as:

- an efficient system for oil recovery/spill presentation relative to system size, function and unit cost;

- minimal ships crew requirements for safe operation and deployment;

- extent of development and commercialization; and

- safe to store, deploy and operate.

Of the original 12 system alternatives, five were selected for further consideration. These five systems were then assessed relative to accounts of historical Canadian oil spill tanker accidents. The resulting four primary alternatives for a tanker self-help system are identified above.

A review of Canadian and maritime legislation was then undertaken to identify means of implementing the aforementioned alternate systems. The Canada Shipping Act and the Arctic Waters Pollution Prevention Act (AWPPA) offer the more immediate avenue for implementation because they don't require the signatory approval of other countries as does the International Maritime Organization (IMO).

It will be appreciated that the four identified systems are mainly applicable to grounding accidents where substantial oil remains in the damaged tanks. This would not be so in the case of collisions; in these cases the systems could be used to remove oil in the vicinity of the damaged tanks to prevent subsequent further ruptures of surrounding internal structures.

The above four systems are discussed more fully in this section of the report as they relate to common components of a single preferred system. In particular the system development needs and implementation are suggested.

7.1 System Description

The four system alternatives are considered as part of a combined solution to address a common problem - tanker self-help pollution prevention.

The tanker self-help system proposed is a combination of the preferred alternatives and is summarized as follows.

A requirement of tanker operators in Canadian waters to demonstrate:

- a minimum capability to lighter a given volume of oil in a specified time period;
- a minimum volume of emergency storage capacity onboard;
- a minimum capability to transfer oil internally within the ship at a specified rate (or as per above rate); and
- shipboard oil spill response plans.

It is further proposed that current Canadian regulations be assessed as a mechanism to implement the above.

7.2 System Development

7.2.1 Contingency Planning

Contingency planning is common to all system alternatives and should be supported irrespective of further progress towards the adoption of a physical means of preventing marine pollution.

Numerous countries, including Norway, Germany, Denmark, United Kingdom and the USA, among others are presently supporting an International Maritime Organization (IMO) initiative to develop guidelines for shipboard oil spill response plans (proposal regulation 26 to Annex I of MARPOL 73/78, April 1991).

The reader is referred to the IMO or specifically the Marine Environment Protection Committee for further information.

The analysis reported here would support this initiative. Specifically, crew training in emergency response planning, and identification and implementation of those circumstances wherein the proposed tanker self-help system might be deployed, is recommended.

7.2.2 Oil Transfer and Hydrostatic Loading - Combined

Common to the other three alternatives mentioned is the requirement to have a physical space available onboard ship or external to the ship, before and after an oil spill incident, respectively, which can serve as an emergency storage tank. No particular requirements for this storage space need be specified other than it must be of a specified volume and provide for safe handling of products (eg. not prone to the formation of vapour and explosion proof). Further, it may be utilized for some other purpose when not utilized as an emergency storage tank provided it is available on short notice, and regulatory penalties are imposed for misuse in cases of emergency. Ballast tanks are often proposed; however, in ships of other configurations, storage space other than ballast tanks may be specified. It is proposed that minimal retro-fitting be required and the required configuration be left to the marine industry and tanker owner to resolve.

A second functional component of the three alternatives discussed is the requirement for oil transfer pumping and piping. Specific system specifications might require a specified fluid pump rate at some ratio to tank storage capacity - sufficient pumping and piping capacity to empty a nominal tankage by 50% in 8 hours, for example.

The internal oil transfer option suggests that "over-the-top" oil transfer using portable hardware is preferred, whereas the external oil lightering option requires ship-to-ship or "over-the-ocean" piping or hoses.

The system proposed here would not attempt to specify system design components but rather would require a demonstrated capability on behalf of the tanker owner to:

1. provide lightering capability at a minimum specific rate while meeting minimum requirements for over-the-ocean transfer; e.g., storage volume equivalent to the void created by hydrostatic loading of the fluid type in two-tanker holds. Transfer rate should be specified to transfer said volume within a certain time period (8 hours);

2. provide internal oil transfer as a necessary component of lightering capability;

3. have hydrostatic loading as demonstrated emergency oil storage space rather than as a specific vessel requirement.

7.3 System Characteristics

The proposed system concentrates on implementation of a policy rather than specifying equipment per se. This is proposed to offer the marine industry and tanker owner the maximum possible flexibility in meeting a minimum self-help capability based upon oil transfer suited to each particular ship.

There are however, several key characteristics of such a system which determine its success as an effective self-help mechanism.

First, a cargo capacity penalty/or an associated unit cost increase of transporting oil might occur. A minimum estimate of this cost increase would be where a ship has existing storage capacity which could be used and is factored into existing costs of transport. A worst case cost increase is estimated at 15 to 20% as a function of a similar decrease in overall tanker loading requirements to successfully address one damaged containment hold.

Second, equipment costs to address pumping and pumping requirements are considered minimal relative to their potential effectiveness and absolute costs.

Each ship could utilize a different configuration, consequently system costs could vary considerably from vessel to vessel. An estimate for a completely self-contained system is about $200,000 based upon pump and piping costs of $80,000 and $100/m x 1000 m, ($Cdn), respectively (Schultze, 1991). The relative cost of transferring a barrel of oil vs spilling it is a matter of opinion.

However, as discussed earlier in the outcome of the spill history section (Summary 3.3) the system as proposed addresses approximately 95% of the historical oil spilled by volume and penalizes only those ships best able to incorporate the added expense, those with the lowest unit transport costs.

Third, the probability of ship services being available for transferring are considered high assuming that groundings is the more likely circumstance for deploying a self-help system. Also, ship crew would be available and would already be familiar, on a tanker, with pumping and piping equipment. The ship's crew should not be required to leave the vessel at sea in order to implement the system.

Fourth, ship stability considerations could render such a system either inoperable or alternatively of some direct benefit. Depending upon the nature of the breach and accident conditions, immediate and accurate information on the stability of the ship given various cargo reconfigurations is necessary for the captain to make informed cargo transfer decisions. A risk exists that the tanker self-help system might not be used given a concern for ship stability.

Fifth, the events at the time of the ship tanker accident determine the rate of fluid release from the cargo hold. There will be circumstances where the proposed system is ineffective because the discharge rate is very quick. For example, ship collisions represent accident circumstances where this may occur. However, this type of accident has historically not occurred often in Canadian waters where oil has been released.

7.4 Implementation

It is suggested that, working in conjunction with an existing ship owner:

- a basic policy specification be derived to define minimum pumping and storage requirements, and
- an existing ship be used to evaluate the proposed self-help system as to:
    - feasibility to meet minimum requirement,
    - installation and maintenance costs based upon the existing ship operating in Canadian waters,
    - crew training in conjunction with emergency response planning, and
- based upon the outcome of the above, legislation mechanisms be further investigated, such as regulatory changes and certificates of compliance on behalf of the tanker owner/operator.

Further, related investigations which would assist the implementation of the aforementioned policy initiatives include:

- the investigation of means of supplying ship's stability information to tanker captains at times of most immediate need, immediately after the accidental release of cargo.

- the investigation of cargo fluid types which might resemble that of liquid hydrocarbons and thereby be included in the proposed policy initiative. No distiction between product and crude tanker types is implied.
- the investigation of foreign ships or occasional ships entering Canadian waters and how they might be impacted and/or otherwise adhere to the proposed policy initiative.

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APPENDIX A

MMS TANKER SPILL DATABASE
(1974 - JUNE 1990)

Spill Inventory for January 1, 1974 to December 31, 1982

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
1	8	1	74	BARGE 3	B	USA	0	0	0		1,097	1,097	1,097	2	FUEL OIL	T	UNSP	UNSP	82	GULF OF MEXICO -CHANNEL IN LOUISIANA
2	14	1	74	ST. MARY	T	LIB	20,000	0	56		2,992	2,992	2,992	2	FUEL OIL	F	UNSP	UNSP	110	MID-ATLANTIC, PORTUGAL
3	15	1	74	(BARGE)	B	UNS	0	0	0	UNSP	510	510	512	1	LIGHT CRUDE	T	30:04N	091:45W	118	ST. MARTINVILLE, LA
4	18	1	74	KEYTRADER	T	USA	19,000	11,476	54	FULL	2,393	2,393	2,393	2	FUEL OIL	T	UNSP	UNSP	118	MISSISSIPPI R., LOUISIANA
5	19	1	74	(BARGE)	B	UNS	0	0	0	UNSP	272	272	272	1	BASRAH CRUDE NO.6 F.	T	40:47N	073:56W	152	YONKERS, NEW YORK
6	2	2	74	HAGENSEE	T	WGE	97,000	0	70		798	798	798	2	NAPHTHA	F	UNSP	UNSP	145	EUROPEAN ATL. PORT/TERMINAL, FRANCE
7	9	2	74	H ENDURANCE	T	CYP	19,000	12,377	53	FULL	997	997	997	1	NIGERIAN CRUDE	F	09:00N	013:00W	2	FREETOWN, SIERRA LEONE, W. AFRICA
8	13	2	74	SEA SPRAY	T	SWE	123,000	0	66		5,986	5,986	5,986	1	CRUDE	F	UNSP	UNSP	0	NORTH SOUTHEAST ASIA
9	19	2	74	ATHOS	T	FRE	84,620	0	65	UNSP	923	923	946	2	NO. 6 FUEL/BUNKER	T	39:51N	075:17W	116	PAULSBORO, NEW JERSEY
10	22	2	74	NAI GIOVANNA	T	ITA	134,000	72,294	72	BALLAST	2,992	2,992	2,992	2	BUNKER FUEL	T	31:50N	145:15W	123	1,200 MI WSW SAN FRANCISCO, CA
11	17	3	74	AEGIS LEADER	T	GRE	86,000	0	66		1,995	1,995	1,995	2	BUNKER FUEL	F	UNSP	UNSP	103	ABU DHABI, PERSIAN GULF
12	0	4	74	SEA SPIRIT	T	UNS	0	0	0	UNSP	6,807	6,807	6,807	1	CRUDE	T	34:00N	118:15W	120	LOS ANGELES HARBOR, CA
13	9	4	74	ELIAS	T	GRE	32,000	19,178	56	PARTIAL	2,993	2,993	2,993	1	CRUDE/ASPHALT	T	40:00N	075:00W	152	DELAWARE R., FT. MIFFLIN, PHIL., PA
14	10	4	74	VISAHAKIT I	T	THA	5,314	0	71	UNSP	767	767	4,986	2	BUNKER/FUEL OIL	F	13:45N	100:30E	62	GULF OF THAILAND
15	15	4	74	IMPERIAL SARNIA	T	CAN	6,724	0	0	UNSP	415	415	476	1	CRUDE	T	44:30N	075:46W	152	ST LAWRENCE SEAWAY, NY
16	22	4	74	KOREA HOPE	T	KOR	19,000	0	54		499	499	499	2	FUEL OIL	F	UNSP	UNSP	26	STRAIT OF MALACCA, SINGAPORE
17	26	4	74	KATINA M.	T	CYP	16,210	10,339	53	UNSP	706	706	706	1	CHINESE CRUDE	F	UNSP	UNSP	131	STRAIT OFF JAPAN
18	3	5	74	TOSA MARU	T	UNS	72,658	0	0	UNSP	181	181	181	1	CRUDE	F	29:04N	049:08E	104	ARABIAN GULF
19	3	5	74	ISOMERIA	T	FRE	62,065	0	56	UNSP	181	181	181	1	CRUDE	F	29:04N	049:08E	104	ARABIAN GULF, KUWAIT
20	16	5	74	ALAGIR	T	RUS	4,000	3,142	61	UNSP	3,989	3,989	3,989	2	FUEL OIL	F	37:29N	010:24E	143	24 MI. N. OF CAPE FARINA NR TUNIS
21	23	5	74	(BARGE)	B	UNS	0	0	0		239	239	239	2	KEROSENE	T	UNSP	UNSP	153	OHIO RIVER MI. 469.6, OH
22	22	6	74	O.N. 524331 (BARGE)	B	UNS	0	0	0	UNSP	3,265	3,265	3,265	1	LIGHT CRUDE	T	30:00N	090:03W	117	NEW ORLEANS, LA MISS. R. MI. 105
23	24	6	74	ABC 2311 (BARGE)	B	USA	4,000	1,216	70	UNSP	2,481	2,481	2,481	1	CRUDE	T	30:00N	090:03W	118	MI 105, MISSISSIPPI RIVER
24	24	6	74	TOTTSVILLE	T	UNS	0	0	0	UNSP	146	146	146	0	UNSPECIFIED	T	UNSP	UNSP	152	NEW YORK
25	27	6	74	NAJD	T	ARA	3,000	3,199	50	FULL	2,992	2,992	2,992	2	RESIDUE OIL/OILCAKES	F	22:00N	039:00E	105	JEDDAH, RED SEA, SAUDI ARABIA
26	8	7	74	TM-10 (BARGE)	B	UNS	0	0	0	UNSP	1,224	1,224	1,224	2	NO. 6 FUEL	T	29:37N	095:00W	82	GALVESTON, TEXAS
27	15	7	74	GREAT LOYALTY	T	LIB	26,000	0	66		499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	324	STRAIT OF MALACCA, SINGAPORE
28	16	7	74	MONMOUTH	T	USA	30,000	0	42		499	499	499	2	FUEL OIL	F	UNSP	UNSP	29	NORTHERN INDIAN OCEAN, ASIA - INDIA
29	19	7	74	(BARGE)	B	UNS	0	0	0		421	421	421	2	GASOLINE: AVIATION	T	42:02N	073:56W	152	HUDSON? R. NEAR NEWBURGH, NY
30	21	7	74	ON 541952 (BARGE)	B	UNS	0	0	0	UNSP	272	272	272	2	NO. 6 FUEL	T	29:50N	093:57W	82	PORT ARTHUR, TEXAS
31	23	7	74	THEODOROS V	T	GRE	44,000	13,157	54	FULL	19,864	19,864	19,864	1	CRUDE	F	21:08N	018:41W	74	MID-ATL., 400M N OF DAKAR, SENEGAL
32	0	8	74	MAR CASPIO	T	ARG	16,725	0	0	PARTIAL	353	353	353	0	UNSPECIFIED	F	34:40S	058:30W	413	BUENOS AIRES, ARGENTINA
33	1	8	74	(BARGE)	B	UNS	0	0	0	UNSP	6,320	6,320	6,320	0	UNSPECIFIED	T	29:30N	090:15W	81	MI 116 MISSISSIPPI RIVER
34	4	8	74	(BARGE)	B	UNS	0	0	0		285	285	285	2	NO. 2 FUEL	T	UNSP	UNSP	153	ILLINOIS R. MI. 139.0, IL
35	4	8	74	JOS. SIMARD	T	CAN	7,153	0	64	UNSP	1,458	1,458	1,458	2	NO. 4 DIESEL FUEL	F	58:43N	062:54W	187	NEWFOUNDLAND, CANADA
36	7	8	74	AL FUNTAS	T	KUW	208,810	0	69	UNSP	384	384	499	1	CRUDE	F	53:31N	008:10E	216	WILHELMSHAVEN, WEST GERMANY
37	9	8	74	METULA	T	HOL	206,719	104,379	68	FULL	45,165	45,165	45,165	1	LIGHT ARABIAN CRUDE	F	52:34S	069:41W	486	SATTELITE BANK, MAGELLAN STR., CHILE
38	14	8	74	MOBIL LUBCHEM	T	BRI	3,310	0	73	UNSP	428	428	428	0	UNSPECIFIED	F	UNSP	UNSP	0	
39	16	8	74	SANT ANBROGIO	T	ITA	263,000	0	72		490	490	490	1	CRUDE	F	UNSP	UNSP	0	PORT OR TERMINAL, NETHERLANDS
40	26	8	74	IRVINGWOOD	T	CAN	3,000	0	52		499	499	499	2	GASOLINE	F	UNSP	UNSP	151	ST. LAWRENCE R., QUEBEC, CANADA
41	29	8	74	ESSO GARDEN STATE	T	LIB	0	0	67		5,034	5,034	5,034	1	CRUDE	F	UNSP	UNSP	0	PORT OR TERMINAL, BRAZIL
42	25	9	74	ELEFTHERIA	T	GRE	14,000	8,886	54	FULL	9,973	9,973	9,973	2	LUBRICANTS	F	06:00N	016:00W	2	ATLANTIC O.-SIERRA LEONE, W. AFRICA
43	26	9	74	TRANSHURON	T	USA	19,650	11,971	45	FULL	4,414	3,989	4,414	1	CRUDE (NAPHTHA?)	F	11:30N	073:01E	65	KILTAN ISLAND - SW COAST OF INDIA
44	30	9	74	GOLDEN ROBIN	T	BRI	28,175	17,539	53	UNSP	499	283	499	2	NAPHTHA/BUNKER C	F	48:05N	066:22W	152	GULF OF ST. LAWRENCE, N.BRUN., CANADA
45	6	10	74	MESSINIAKI BERGEN	T	GRE	29,751	17,485	70	UNSP	340	340	415	2	NO. 6 FUEL OIL	T	41:18N	072:55W	152	NEW HAVEN, CONNECTICUT
46	9	10	74	DAGNY	T	UNS	44,700	0	0	UNSP	993	993	1,017	1	ARABIAN CRUDE	T	27:49N	097:26W	82	CORPUS CHRISTI, TEXAS
47	9	10	74	BOUCHARD 65 (BARGE)	B	USA	10,000	0	0		4,986	4,986	4,986	2	FUEL OIL	T	UNSP	UNSP	151	AMERICAN ATLANTIC O., MASSACHUSETTS
48	10	10	74	TEKTON	T	LIB	26,000	15,807	55	BALLAST	499	499	499	2	BUNKER FUEL	F	31:13S	031:35E	440	INDIAN O. OFF DURBAN S. AFRICA
49	10	10	74	TROJAN	T	USA	24,000	0	45		9,973	9,973	9,973	2	FUEL OIL	F	UNSP	UNSP	60	PACIFIC O.?/CHINA SEA? - PHILLIPINES
50	16	10	74	INGEBORG	T	UNS	0	0	0	UNSP	233	233	233	2	GASOLINE	F	50:09N	005:23E	216	NORTH SEA
51	16	10	74	NIKKO MARU	T	JAP	35,000	0	56		499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	26	STRAIT, S. CHINA SEA, SINGAPORE
52	22	10	74	UNIVERSE LEADER	T	LIB	92,373	51,400	56	UNSP	2,293	2,293	2,593	1	KUWAIT CRUDE	F	51:30N	010:00W	181	BANTRY BAY, IRELAND
53	22	10	74	ERCOLE	T	ITA	54,328	0	61	UNSP	1,995	298	1,995	1	CRUDE	T	30:10N	091:15W	118	MI 174.2 MISSISSIPPI RIVER, LA
54	9	11	74	YUYO MARU 10	T	JAP	52,836	43,723	66	FULL	49,864	49,864	49,864	2	NAPHTHA	F	35:30N	139:40E	131	TOKYO BAY, JAPAN
55	13	11	74	SAVFUEL	T	HON	1,000	614	44	FULL	598	598	598	2	FUEL OIL	F	17:20N	087:30W	45	LIGHTHOUSE REEF-BELIZE, BRI. HOND.
56	26	11	74	PETER MAERSK	T	DAN	51,400	0	64	FULL	1,695	1,224	1,695	2	FUEL OIL/NAPTHA	F	49:30N	000:07W	145	ENGLISH CHANNEL, FRANCE
57	5	12	74	CHERRY VINSTRA	T	SIN	21,000	13,067	56	FULL	14,966	14,966	14,966	1	CRUDE	F	21:01N	062:07E	102	ARABIAN SEA, GULF OF OMAN
58	21	12	74	JOHN COLOCOTRONIS	T	GRE	34,000	21,185	56	BALLAST	997	997	997	2	BUNKER FUEL	F	34:20N	035:40E	141	MINIEH, NEAR TRIPOLI, LEBANON
59	24	12	74	(BARGE)	B	UNS	0	0	0	UNSP	204	204	389	1	CRUDE	T	30:15N	091:15W	118	MI 88.3 MISSISSIPPI RIVER
60	0	1	75	HEIWA MARU	T	JAP	224,000	0	73		3,810	3,810	3,810	1	CRUDE	F	UNSP	UNSP	0	SINGAPORE
61	6	1	75	SHOWA MARU	T	JAP	237,698	116,136	73	UNSP	6,981	4,278	6,981	1	CRUDE	F	01:09N	103:49E	26	STRAIT OF MALACCA
62	10	1	75	AFRAN ZODIAC	T	LIB	227,776	0	73	UNSP	335	335	499	2	BUNKER C	F	51:41N	009:30W	181	BANTRY BAY, IRELAND
63	12	1	75	MASTER STATHIOS	T	GRE	21,000	12,297	60	PARTIAL	19,946	19,946	19,946	2	FUEL OIL	F	30:45S	030:47E	440	50 MI. DURBAN, S. AFRICAN INDIAN O
64	13	1	75	BRITISH AMBASSADOR	T	BRI	46,000	27,114	58	FULL	44,898	44,898	44,898	1	CRUDE	F	24:02N	137:45E	86	180 MI. W. OF IWO JIMA I, PACIFIC
65	20	1	75	ATHENIAN STAR	T	CYP	20,051	11,879	58	UNSP	2,313	2,313	4,137	1	CRUDE	F	UNSP	UNSP	0	MID-ATLANTIC O. OFF NEW HAMPSHIRE
66	21	1	75	OSWEGO PATRIOT	T	LIB	99,416	0	65		5,034	5,034	5,442	1	CRUDE	T	35:00N	130:00W	121	MID N. PACIFIC OFF LOS ANGELES, CA
67	21	1	75	LUCKY ERA	T	CYP	20,000	12,635	56	BALLAST	499	499	499	2	BUNKER FUEL	F	22:27N	072:38W	80	EASTERN REEF, MAYAGUANA I., BAHAMAS
68	22	1	75	MICHAEL C. LEMOS	T	GRE	240,980	124,009	71	FULL	1,218	1,076	1,293	1	IRANIAN CRUDE	T	17:42N	064:45W	43	ST. CROIX, U.S. VIRGIN ISLANDS
69	29	1	75	JAKOB MAERSK	T	DAN	88,000	48,252	66	FULL	78,576	78,576	83,771	1	IRANIAN CRUDE	F	41:11N	008:44W	145	PORT LEIXOES, N. PORTUGAL
70	29	1	75	TS-86 (85?) (BARGE)	B	USA	0	0	0		204	204	4,986	1	CRUDE	T	UNSP	UNSP	81	LOWER MISSISSIPPI R. MI. 87.0, LA
71	31	1	75	CORINTHOS	T	LIB	54,120	30,705	63	PARTIAL	1,620	1,620	39,891	1	ALGERIAN CRUDE	T	39:48S	075:25W	116	MARCUS HOOK, DELAWARE RIVER, PA

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
72	5	2	75	KISARAGI MARU NO. 3	T	UNS	1,144	0	0	UNSP	215	215	215	2	HEAVY FUEL OIL	F	33:44N	130:11E	131	SEA OF JAPAN
73	5	2	75	WGH NO. 16 (BARGE)	B	USA	0	0	0		265	265	265	2	NO. 2 FUEL	T	UNSP	UNSP	153	OHIO RIVER MI. 491.0, OH
74	11	2	75	PANGLOBAL FRIENDSHIP	T	LIB	3,000	1,853	67	FULL	1,995	1,995	1,995	2	FUEL OIL	F	11:04N	061:34W	43	CARRIBEAN ZONE, 20 MI OFF TRINIDAD
75	13	2	75	CAPULONIX	T	LIB	50,000	0	59		798	798	798	1	CRUDE	F	UNSP	UNSP	29	NORTHERN INDIAN OCEAN, INDIA
76	16	2	75	IOANNA	T	GRE	16,000	9,918	45	BALLAST	499	499	499	2	BUNKER FUEL	F	44:44N	014:11E	179	GALIOLA I., RIJEKA, YUGOSLAVIA
77	3	3	75	IOT-105 (BARGE)	B	USA	0	0	0		2,721	2,721	2,721	2	GASOLINE: AUTOMOTIVE	T	UNSP	UNSP	118	LOWER MISSISSIPPI R. MI. 639.5, MS
78	3	3	75	TRAMONTANA	T	FIN	27,000	0	58		997	997	997	2	BUNKER FUEL	F	UNSP	UNSP	402	MAURITIUS I., AFRICAN INDIAN OCEAN
79	5	3	75	BARGE 13	B	USA	0	0	0		2,177	2,177	2,177	1	CRUDE	T	UNSP	UNSP	0	RIVER/ESTUARY, LOUISIANA
80	5	3	75	B-117 (BARGE)	B	USA	0	0	0		218	218	218	1	CRUDE	T	UNSP	UNSP	118	LOWER MISSISSIPPI R. MI. 435.8, MS
81	5	3	75	B-421/BARGE 13(BARGES)	B	USA	0	0	0		2,775	2,194	2,775	1	CRUDE	T	UNSP	UNSP	118	LOWER MISSISSIPPI R. MI. 435.8, MS
82	11	3	75	JULY STAR	T	SIN	27,000	15,998	57	BALLAST	997	997	997	2	BUNKER FUEL	F	37:55N	006:15E	144	WESTERN MEDITERRANEAN SEA, ALGERIA
83	14	3	75	ASIATIC	T	PAN	1,000	0	45	999	997	997	997	2	ASPHALT	F	02:28N	101:40E	26	STR. MALACCA,PORT DICKERSON,SUMATRA
84	26	3	75	TARIK IBN ZIYAD	T	IRQ	118,250	62,301	74	UNSP	14,959	8,828	14,959	1	CRUDE	F	23:00S	043:00W	376	RIO DE JANIERO, BRAZIL
85	1	4	75	SHELL 2 (BARGE)	B	USA	0	0	0		1,995	1,995	1,995	2	ASPHALT	T	UNSP	UNSP	58	MID NORTHERN PACIFIC OCEAN, GUAM
86	4	4	75	SPARTAN LADY	T	LIB	20,724	12,689	55	FULL	19,436	16,891	19,946	2	NO. 6 FUEL	T	39:02N	071:00W	116	12-200 MI. OFF NEW JERSEY
87	14	4	75	OTE MARU 15 (BARGE)	B	JAP	0	0	0		490	490	490	1	CRUDE	F	UNSP	UNSP	0	OFF JAPAN
88	17	4	75	MITSU MARU 3 (BARGE)	B	JAP	2,000	0	68	UNSP	486	486	486	2	FUEL OIL	F	UNSP	UNSP	131	JAPAN
89	17	4	75	TOSA MARU	T	JAP	72,658	42,790	65	BALLAST	1,713	1,713	1,713	2	BUNKER	F	01:20N	103:50E	26	STR. OF MALACCA, SINGAPORE
90	25	4	75	BUTANE (BARGE)	B	USA	0	0	0	UNSP	680	677	680	1	CRUDE	T	29:47N	090:53W	82	NEW ORLEANS, LA MISS. R. MI. 102.0
91	13	5	75	EPIC COLOCOTRONIS	T	GRE	64,000	37,469	65	FULL	5,714	5,714	5,714	1	VENEZULEAN CRUDE	F	19:16N	067:55W	43	CARRIBEAN, 60 MI. NW OF PUERTO RICO
92	14	5	75	ESSO KAGOSHIMA	T	LIB	261,000	0	0		490	490	490	1	CRUDE	F	UNSP	UNSP	0	INDIAN OCEAN, OFF SOUTH AFRICA
93	6	6	75	EIKO MARU	T	JAP	236,000	0	71		490	490	490	1	CRUDE	F	UNSP	UNSP	0	NORTHEAST ASIA, OFF JAPAN
94	12	7	75	OLYMPIC DALE	T	LIB	31,000	0	54		499	499	499	1	CRUDE	F	UNSP	UNSP	0	ANTARTICA
95	13	7	75	PRINCESS ANNE-MARIE	T	GRE	66,851	34,707	64	UNSP	13,526	13,526	13,526	1	BASRAH CRUDE	F	23:30S	105:30E	397	BARROW ISLAND, AUSTRALIA
96	16	7	75	PERA/LORENZO HALCOUSSI	T	GRE	71,143	0	0	UNSP	272	245	272	2	BUNKER C/NO. 6 FUEL	T	33:43N	118:16W	120	LOS ANGELES HARBOR, CA
97	20	7	75	GARBIS	T	LIB	74,107	0	0	UNSP	367	367	367	2	BUNKER C	T	24:38N	081:30W	81	STRAITS OF FLORIDA
98	10	8	75	SHAMROCK (BARGE)	B	USA	0	0	0	UNSP	408	408	408	2	NO. 6 FUEL	T	39:13N	076:33W	116	CHESAPEAKE BAY, MARYLAND
99	15	8	75	GLOBTIK SUN	T	BRI	54,760	33,526	61	FULL	2,721	2,375	2,992	1	CRUDE	T	28:25N	092:55W	82	185 MI. SW OF NEW ORLEANS, LA
100	15	8	75	ARIES	T	PAN	20,000	13,432	54	BALLAST	997	997	997	2	FUEL OIL	F	UNSP	UNSP	47	PACIFIC O.,W.COAST MEX.,BAHIA BAMBA
101	30	8	75	DIMITRIOS D M	T	LIB	22,000	0	53		499	499	499	2	FUEL OIL	F	UNSP	UNSP	9	PACIFIC O.?, PANAMA
102	0	9	75	CHRISTINA II	T	GRE	81,300	0	0	UNSP	1,677	1,677	1,677	0	UNSPECIFIED	F	UNSP	UNSP	216	OFF DUTCH COAST
103	22	9	75	THORSHAMMER	T	UNS	0	0	0	UNSP	14,099	14,099	14,099	0	UNSPECIFIED	F	29:20N	048:00E	104	KUWAIT
104	29	9	75	PACIFIC COLOCOTRONIS	T	GRE	81,300	41,964	66	UNSP	1,995	1,324	1,995	1	CRUDE	F	52:58N	004:47E	216	DUTCH REGION, NORTH SEA
105	7	10	75	BOUCHARD 115 (BARGE)	B	USA	0	0	0	UNSP	330	330	330	2	NO. 4/6 FUEL	T	40:46N	073:54W	152	EAST RIVER, NEW YORK CITY
106	7	10	75	CHOTIN 2181X (BARGE)	B	USA	0	0	0		544	544	544	2	GASOLINE & DIESEL	T	UNSP	UNSP	117	OHIO RIVER MI. 809.6, KY
107	26	10	75	SAN ROCCO	T	LIB	21,000	12,202	59	BALLAST	997	997	997	2	BUNKER FUEL	F	19:20N	069:24W	43	CARIB., 1 MI. W CAYO LIMON,DOM.REP.
108	28	10	75	KRITI SUN	T	GRE	123,000	61,054	74	EMPTY	2,992	2,992	2,992	2	BUNKER FUEL	F	01:14N	103:41E	26	STRAIT OF MALACCA, 3 MI SINGAPORE I
109	0	11	75	RIO IQUAZU	T	UNS	9,754	0	0	UNSP	228	228	228	0	UNSPECIFIED	F	55:40N	012:45E	215	ORESUND SOUND, SWEDEN/DENMARK
110	12	11	75	OLYMPIC ALLIANCE	T	LIB	219,913	97,206	70	UNSP	9,932	2,648	9,932	1	CRUDE	F	50:59N	001:35E	216	ENGLISH CHANNEL, UK
111	9	12	75	Z-102 (BARGE)	B	USA	2,000	0	0		1,620	1,620	1,695	2	NO. 6 FUEL	T	18:29N	066:08W	43	PUERTO RICO
112	24	12	75	AMOCO YORKTOWN	T	LIB	79,313	0	0	UNSP	245	245	246	1	TRINIDAD CRUDE	T	29:22N	094:53W	82	TEXAS CITY, TEXAS
113	26	12	75	WILLIAM WHEELWRIGHT	T	BRI	52,000	0	60		698	698	698	2	FUEL OIL	F	UNSP	UNSP	2	ATLANTIC O., WEST AFRICA, LIBERIA
114	31	12	75	DELAWARE	T	USA	72,100	0	0	UNSP	292	259	292	2	LIGHT DIESEL/NO. 2	T	41:05N	073:55W	152	LONG ISLAND SOUND
115	0	1	76	IRENES SINCERITY	T	CYP	27,000	0	59		499	499	499	2	FUEL OIL	F	UNSP	UNSP	215	BALTIC SEA, SWEDEN
116	15	1	76	ESSO REGULUS	T	PAN	4,000	0	45		2,992	2,992	2,992	2	GASOLINE	F	UNSP	UNSP	25	CELEBES SEA?, BORNEO
117	18	1	76	TRINITY NAVIGATOR	T	LIB	42,000	26,626	59	UNSP	997	997	997	2	BUNKER FUEL	F	UNSP	UNSP	142	MEDITER. SEA, MARSA EL BREGA, LIBYA
118	24	1	76	OLYMPIC BRAVERY	T	LIB	276,000	126,622	75	BALLAST	798	798	798	2	FUEL OIL	F	48:28N	005:07W	145	1 MI NE CREAC'H LIGHT,USHANT I,FRAN
119	2	2	76	STCO-101 (BARGE)	B	USA	0	1,223	56	UNSP	809	809	810	1	CRUDE / NO. 6 FUEL	T	37:50N	076:09W	116	CHESAPEAKE BAY, VA (MD?)
120	4	2	76	SAINT PETER	T	LIB	34,175	20,678	57	FULL	33,907	9,973	33,907	1	COLOMBIAN? CRUDE	F	01:30N	079:30W	8	30 MI W OF PUNTA MANGLARES,COLOMBIA
121	8	2	76	FLORIDA (BARGE)	B	USA	0	0	0		729	729	729	2	JET FUEL: JP-1(KERO)	T	UNSP	UNSP	153	ILLINOIS? R. MI. 214.5, IL
122	14	2	76	DRUPA	T	BRI	70,871	0	65	UNSP	1,995	357	1,995	1	IRANIAN CRUDE	F	58:56N	005:35E	216	TANANGER, NORWAY
123	16	2	76	NANYANG	T	SOM	20,321	13,095	57	FULL	17,655	17,655	19,946	1	CRUDE	F	22:25N	115:41E	97	S. CHINA SEA, 90 MI E OF HONG KONG
124	18	2	76	SCORPIO	T	GRE	45,000	26,032	57	FULL	29,932	29,932	29,932	1	CRUDE	F	18:00N	091:00W	46	GULF OF CAMPECHE?,11 MI FR PORT,MEX
125	24	2	76	CHRISTINA	T	GRE	32,000	19,300	60	BALLAST	997	997	997	2	BUNKER FUEL	T	37:[illegible]N	081:00W	116	BALTIMORE, MARYLAND
126	24	2	76	SJT-4 (BARGE)	B	UNS	0	1,279	0	UNSP	518	518	518	1	CRUDE	T	29:57N	089:57W	81	CHALMETTE, LA MISS. R. MI. 88.8
127	0	3	76	ARYADOOT	T	IND	18,134	0	0	UNSP	224	224	224	0	UNSPECIFIED	F	36:09N	005:21W	109	GIBRALTAR
128	1	3	76	SULLY (BARGE)	B	USA	0	1,142	0	UNSP	190	190	191	1	CRUDE	T	29:38N	090:56W	82	GIBSON, LA
129	5	4	76	MYSELLA	T	BRI	213,000	0	70		2,993	2,993	2,993	1	CRUDE	F	UNSP	UNSP	26	STRAIT OF MALACCA, SINGAPORE
130	25	4	76	ELLEN CONWAY	T	LIB	48,000	26,956	61	FULL	29,932	29,932	29,932	1	LIBYAN CRUDE	F	35:50N	000:30W	109	MED. SEA, OUTER HARB ARZEW, ALGERIA
131	29	4	76	TEXACO ILLINOIS	T	UNS	24,998	0	0	UNSP	272	221	272	1	NAPHTHA INDIAN CRUDE	T	39:53N	075:09W	116	WESTVILLE, NJ
132	4	5	76	NAT.MAR.SERV. 3105(BARGE)	B	USA	0	0	0	UNSP	680	680	798	2	BUNKER C NO. 6 FUEL	T	29:30N	094:53W	82	GALVESTON BAY, TEXAS
133	4	5	76	DONG WHA 13 (BARGE)	B	KOR	1,000	591	57	FULL	499	499	499	2	RESIDUE OIL SLUDGE	F	33:30N	129:18E	132	OFF IKITSUKI I, NAGASAKI, JAPAN
134	12	5	76	URQUIOLA	T	SPA	111,225	59,723	73	FULL	100,725	77,683	100,725	1	KUWAIT CRUDE	F	43:24N	008:22W	145	LACORUNA, SPAIN
135	16	5	76	EUROASIA MONARCH	T	SIN	91,000	0	[illegible]		490	490	490	1	CRUDE	F	UNSP	UNSP	0	PORT, GABON, SOUTHERN W. AFRICA
136	23	6	76	NEPCO 140 (BARGE)	B	USA	18,000	0	0	UNSP	972	972	1,167	2	NO. 6 FUEL	T	44:20N	075:55W	151	ST. LAWRENCE SEAWAY, NY MI. 66.0
137	28	6	76	MESURADO	T	LIB	1,000	534	68	FULL	499	499	499	2	FUEL OIL/GASOIL	F	05:48N	010:01W	2	2 MI. OFF LOWER BUCHANAN, LIBERIA
138	30	6	76	AL DAMMAM	T	ARA	19,000	12,333	53	UNSP	14,966	14,966	14,966	1	CRUDE	F	UNSP	UNSP	0	MEDITERRANEAN,AGIOI THEODOROI,GREE
139	30	6	76	J. R. GREY	T	LIB	0	0	0		272	247	272	1	CRUDE	T	45:1[illegible]N	065:59W	151	BAY OF FUNDY, MAINE - NOVA SCOTIA
140	0	7	76	BRAZILIAN FAITH	T	LIB	191,986	0	0	UNSP	5,296	5,296	5,296	0	UNSPECIFIED	F	03:30N	102:00E	26	STRAIT OF MALACCA
141	5	7	76	CAPETAN MATHIOS	T	GRE	31,000	18,411	62	BALLAST	499	499	499	2	BUNKER FUEL	F	24:16N	079:10W	80	W. OF ANDROS I., CARIBBEAN, BAHAMAS
142	23	7	76	BUM HAN	T	KOR	6,000	0	62		598	598	598	2	FUEL OIL	F	UNSP	UNSP	166	PACIFIC O., KOREA

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
143	24	7	76	DIEGO SILANG	T	PHI	0	51,836	74	UNSP	5,296	5,296	5,296	1	CRUDE	F	01:47N	102:53E	26	STRAIT OF MALACCA, MALAYSIA
144	28	7	76	CRETAN STAR	T	CYP	29,892	18,064	55	FULL	29,918	25,243	29,918	1	CHINESE/ARAB. CRUDE	F	20:20N	070:05E	29	450 MI OFF BOMBAY, INDIA
145	8	9	76	GATAPETROL	T	CYP	2,000	0	36		997	997	997	2	GASOLINE	F	UNSP	UNSP	141	EASTERN MEDITERRANEAN SEA, LEBANNON
146	11	9	76	RYOYO MARU	T	JAP	96,000	52,157	65	BALLAST	1,995	1,995	1,995	2	BUNKER FUEL	F	33:00N	132:30E	131	BUNGO STRAIT, JAPAN
147	12	9	76	OLYMPIC RIDER	T	LIB	59,067	0	60	FULL	441	441	441	1	CRUDE	F	04:04S	039:40E	32	NEAR KENYA
148	26	9	76	STCO 225 (BARGE)	B	USA	0	0	0		136	136	136	1	CRUDE	T	29:58N	093:51W	82	NEAR BEAUMONT, TX
149	26	9	76	AL BILAD	T	KUW	103,000	0	67		490	490	490	1	CRUDE	F	UNSP	UNSP	0	PORT, S.W. AFRICA, NIGERIA
150	4	10	76	LSCO PETROCHEM	T	PHI	19,000	0	53		14,959	14,959	14,959	2	FUEL OIL	T	UNSP	UNSP	81	GULF OF MEXICO, LOUISIANA
151	5	10	76	SEALIFT PACIFIC	T	USA	25,401	17,300	73	UNSP	1,282	1,146	4,354	2	JP-5 JET FUEL/KEROSE	T	60:43N	151:25W	232	COOK INLET, ALASKA
152	9	10	76	CORONA ENERGY	T	LIB	34,000	0	57		997	997	997	2	BUNKER FUEL	F	UNSP	UNSP	46	PACIFIC O., MEXICO
153	14	10	76	BOHLEN	T	DDR	11,570	7,644	61	FULL	6,807	6,807	6,807	1	CRUDE	F	48:11N	005:12W	145	55 KM OFF BREST, FRANCE
154	16	10	76	GOLDEN STAR (BARGE)	B	SWE	1,000	0	62		997	997	997	2	FUEL OIL	F	UNSP	UNSP	215	BALTIC SEA, SWEDEN
155	27	10	76	CITTA DI SAVONA	T	ITA	63,782	0	63	FULL	883	883	2,992	1	CRUDE	F	01:20N	103:50E	26	STRAIT OF MALACCA, SINGAPORE
156	29	10	76	RICHARD C. SAUER	T	LIB	64,775	0	65	UNSP	898	723	898	1	LIGHT ARABIAN CRUDE	T	40:32N	074:15W	152	PERTH AMBOY, NEW JERSEY
157	0	11	76	OSWEGO HOPE	T	LIB	64,775	0	0	UNSP	711	711	711	0	UNSPECIFIED	T	40:31N	074:17W	152	PERTH AMBOY, NEW JERSEY
158	8	11	76	SERIA	T	HOL	73,000	0	61		694	694	694	1	CRUDE	F	UNSP	UNSP	0	SUEZ CANAL, EGYPTIAN WATERS
159	23	11	76	SOUTHERN SUN	T	LIB	116,000	48,629	71	PARTIAL	997	997	997	2	BUNKER FUEL	F	UNSP	UNSP	143	MED. SEA, ZUETINA OIL TERM., LYBIA?
160	30	11	76	ELK RIVER (BARGE)	B	USA	1,000	0	0		698	698	698	2	FUEL OIL	T	UNSP	UNSP	116	RIVER OR ESTUARY, VIRGINIA
161	3	12	76	N 30 (BARGE)	B	TRI	0	0	0		1,361	1,361	1,361	1	CRUDE	T	UNSP	UNSP	0	AMERICAN ATLANTIC, TRINIDAD, CUBA
162	15	12	76	ARGO MERCHANT	T	LIB	28,691	18,743	53	FULL	24,295	22,195	27,924	2	NO. 6 FUEL/NAPTHA	T	41:01N	069:27W	151	45 KM SE OF NANTUCKET, MA
163	17	12	76	SANSINENA	T	LIB	71,763	38,562	58	EMPTY	3,239	2,893	4,762	2	NO. 6/BUNKER/NAPTHA	T	33:43N	118:16W	120	LOS ANGELES HARBOR, CA
164	18	12	76	BETHIOUA	T	ALG	31,190	17,692	76	FULL	1,476	1,476	1,476	2	MOTOR GAS	F	40:06S	146:48E	465	TAMAR RIVER, TASMANIA
165	20	12	76	JANILL	T	PAN	19,000	12,372	53	EMPTY	499	499	499	2	BUNKER FUEL	F	16:00N	087:30W	46	CARIBBEAN, PUERTOCORTEZ, HONDURAS
166	24	12	76	PECK SLIP (BARGE)	B	USA	0	5,869	72	UNSP	1,130	1,130	1,130	2	FUEL OIL	F	28:19N	072:07W	80	ATLANTIC OCEAN BAHAMAS
167	28	12	76	OLYMPIC GAMES	T	LIB	62,346	32,380	64	FULL	434	379	4,986	1	LIGHT ARABIAN CRUDE	T	39:48N	075:25W	116	DELAWARE RIVER, PA
168	30	12	76	GRAND ZENITH	T	PAN	30,009	18,736	53	FULL	28,921	23,150	28,921	2	NO. 6 FUEL OIL	T	41:18N	058:48W	150	ATLANTIC O., MASSACHUSETTS
169	9	1	77	NEW YORK (BARGE)	B	USA	0	14,187	0	UNSP	262	262	262	2	DIESEL NO. 2 FUEL	T	27:56N	082:23W	81	TAMPA, FLORIDA
170	18	1	77	IRENES CHALLENGE	T	LIB	33,253	21,090	56	FULL	33,907	8,709	33,907	1	HEAVY VENEZ. CRUDE	F	26:53N	173:52W	90	200 MI (320 KM SE) OF MIDWAY ISLAND
171	19	1	77	MAKIS	T	GRE	1,000	0	44		499	499	499	2	GASOLINE	F	UNSP	UNSP	143	MEDITERRANEAN SEA, LIBERIA
172	21	1	77	IMPERIAL BEDFORD	T	UNS	14,204	0	0	UNSP	181	181	181	2	NO. 2 FUEL	F	46:14N	063:09W	151	NOVA SCOTIA, CANADA
173	27	1	77	EXXON 119 (BARGE)	B	USA	0	0	0		499	499	499	2	GASOLINE	T	UNSP	UNSP	0	GULF OF MEXICO, TEXAS
174	28	1	77	BARGE NO. 65	B	USA	0	0	0		263	263	499	2	NO. 2 FUEL	T	41:40N	070:39W	151	OFF NEW BEDFORD, MA
175	31	1	77	EXOTIC	T	LIB	152,000	70,337	70	BALLAST	2,992	2,992	2,992	2	BUNKER FUEL	F	31:36N	011:00W	110	ATLANTIC O. W. OF ESSAOUIRA, MOROCCO
176	1	2	77	O.N. 535880 NO. 105(BARGE)	B	USA	0	0	0	UNSP	324	324	518	2	NO. 6 FUEL	T	40:32N	074:15W	152	PERTH AMBOY, NEW JERSEY
177	4	2	77	ETHEL H (II) (BARGE)	B	USA	6,000	0	0	UNSP	1,361	1,264	1,361	2	NO. 6 FUEL	T	41:21N	073:57W	152	HUDSON RIVER, NEW YORK
178	6	2	77	SAFINA STAR	T	ARA	99,115	0	0	UNSP	3,389	3,389	3,389	1	CRUDE	F	31:00N	032:15E	141	SUEZ CANAL, EGYPT
179	7	2	77	BORAG	T	LIB	35,351	21,616	58	FULL	26,112	22,993	26,112	2	FUEL OIL	F	25:12N	121:45E	96	REEF 4 KM OFF TAIWAN (NR. YEH-LIU)
180	23	2	77	HAWAIIAN PATRIOT	T	LIB	99,447	45,246	65	FULL	84,811	84,811	97,182	1	INDONESIAN CRUDE	F	22:01N	165:29W	89	320 MI W OF HAWAII (KAUAI I.)
181	0	3	77	CELESTE	T	PAN	34,420	0	0	FULL	530	530	530	0	UNSPECIFIED	F	UNSP	UNSP	7	ORINOCO RIVER, VENEZUELA
182	20	3	77	ANSON	T	CYP	34,420	0	0	UNSP	1,995	530	1,995	1	CRUDE	F	08:21N	062:43W	7	ORINOCO R., VENEZUELA
183	20	3	77	CLAUDE CONWAY	T	PAN	46,000	26,650	57	BALLAST	1,995	1,995	1,995	2	BUNKER FUEL	T	32:45N	075:25W	116	150 MI. SE CAPE FEAR, S.CAROLINA
184	24	3	77	FUJIASU MARU 1	T	JAP	1,000	0	66		499	499	499	2	ASPHALT	F	UNSP	UNSP	131	JAPAN
185	0	4	77	GOLDEN CRANE	T	LIB	30,000	0	76		28,921	28,921	28,921	2	NAPHTHA	F	UNSP	UNSP	30	MID-NORTHERN INDIAN OCEAN
186	5	4	77	(BARGE)	B	UNS	0	0	0		243	243	243	2	GASOLINE: AUTOMOTIVE	T	UNSP	UNSP	117	OHIO RIVER MI. 604.2, KY
187	7	4	77	ASTRO LEO	T	PAN	90,000	0	76		993	993	993	1	CRUDE	F	UNSP	UNSP	0	OFF JAPAN
188	15	4	77	UNIVERSE DEFIANCE	T	LIB	94,000	51,320	58	BALLAST	2,992	2,992	2,992	2	BUNKER FUEL	F	11:55N	017:39W	38	S. ATLANTIC O., GUINEA
189	9	5	77	CLASSIC	T	GRE	150,000	0	73		490	490	490	1	CRUDE	F	UNSP	UNSP	0	RIVER, EAST GERMANY
190	9	5	77	PETROS HADJIKYRIKOS	T	GRE	34,957	0	0	UNSP	176	176	176	0	UNSPECIFIED	F	51:27N	000:45E	216	THAMES ESTUARY, UK
191	27	5	77	CARIBBEAN SEA	T	PAN	30,661	18,372	58	FULL	24,717	24,717	29,932	1	VENEZUELAN CRUDE	F	11:34N	089:51W	45	S. OF EL SALVADOR CENTRAL AMER.
192	14	6	77	OSWEGO GLORY	T	UNS	97,409	0	0	UNSP	1,265	1,265	1,265	2	FUEL OIL	F	52:19S	068:07W	486	ATLANTIC OCEAN
193	23	6	77	SILJESTAD	T	NOR	154,000	0	70		997	997	997	2	BUNKER FUEL	F	UNSP	UNSP	68	PERSIAN GULF, DUBAI
194	25	6	77	IOT-102 (BARGE)	B	USA	0	0	0		544	544	544	2	NO. 6 FUEL	T	UNSP	UNSP	82	GULF INTERCOAST WTRWY MI. 23.5, LA
195	26	6	77	ACT-586 (BARGE)	B	USA	0	0	0	UNSP	243	243	243	2	NO. 6 FUEL	T	37:13N	076:26W	116	OFF DELAWARE VA?
196	27	6	77	CAROLINE (BARGE)	B	USA	0	0	0		598	598	598	2	FUEL OIL	T	UNSP	UNSP	152	NEW YORK
197	22	7	77	DAUNTLESS COLOCOTRONIS	T	GRE	52,000	25,476	65	FULL	2,041	2,041	2,041	1	ARABIAN LIGHT CRUDE	T	UNSP	UNSP	0	MI. 89 MISS. RIVER, LOUISIANA
198	28	7	77	ANTIPOLIS & ROMELIA (LIB)	T	GRE	42,000	24,119	59	EMPTY	1,995	1,995	1,995	2	BUNKER FUEL	F	UNSP	UNSP	441	AFRICAN INDIAN OCEAN, S. AFRICA
199	29	7	77	OSWEGO TARMAC	T	PAN	17,000	0	44		9,973	9,973	9,973	2	ASPHALT	F	UNSP	UNSP	43	CARIBBEAN, NETHERLANDS ANTILLES
200	5	8	77	(U.S. NAVY TANKER)	T	UNS	0	0	0	UNSP	318	318	318	2	FUEL OIL	F	75:00N	065:00W	259	WEST COAST OF GREENLAND
201	5	8	77	DELAWARE (BARGE)	B	USA	0	0	0	UNSP	204	204	204	2	DIESEL NO. 2-D FUEL	T	29:35N	090:44W	82	HOUMA, LA INTERCOAST. WTWY. MI. 55
202	10	8	77	URSS 1	T	RUS	20,000	0	0		19,864	19,864	19,864	1	CRUDE	F	UNSP	UNSP	0	RIVER NEAR BLACK SEA, BOSPHORUS
203	13	8	77	AGIP VENEZIA	T	ITA	51,304	0	61	FULL	4,598	4,598	4,598	1	CRUDE/LIBYAN AMNA	F	35:35N	016:11E	143	160 KM OFF MALTA
204	21	8	77	(UNKNOWN)	U	UNS	0	0	0	UNSP	144	144	144	2	LOW GRADE BUNKER C	T	38:20N	075:05W	116	OCEAN CITY, MD
205	7	9	77	(AMOCO TANKER)	T	UNS	0	0	0	UNSP	176	176	176	1	NORTH SEA CRUDE	F	56:42N	002:26W	181	NORTH SEA OFF IRELAND
206	13	9	77	ATLANTIC MARQUESS	T	LIB	88,272	0	0	FULL	229	229	229	1	ARABIAN CRUDE	T	UNSP	UNSP	118	LOWER MISSISSIPPI RIVER
207	26	10	77	TSESIS	T	RUS	19,334	12,588	68	UNSP	1,306	1,097	1,306	2	FUEL OIL	F	58:50N	017:44E	215	NEAR STOCKHOLM, SWEDEN
208	28	10	77	AL SABBIYAH	T	KUW	61,000	35,751	65	UNSP	24,898	1,014	24,898	1	CRUDE	F	33:31N	133:33E	131	40 MILES OFF JAPAN
209	29	10	77	AL-RAWDATAIN	T	KUW	326,714	0	76	UNSP	8,976	8,976	10,593	1	KUWAIT CRUDE	F	44:24N	008:56E	180	GENOA, ITALY
210	31	10	77	STCO-213 (BARGE)	B	USA	0	0	0	UNSP	136	136	136	2	NO. 6 FUEL	T	29:21N	094:48W	82	GALVESTON BAY, TEXAS
211	2	11	77	MATSUSHIMA MARU NO.3	T	JAP	74,913	46,226	64	BALLAST	9,932	8,751	9,932	2	LUBRICANTS	F	32:48N	134:30E	131	30 MI. SSE OF MUROTO MISAKI, JAPAN
212	11	11	77	RICHMOND DREDGER	T	UNS	0	0	0	UNSP	363	363	363	2	DIESEL FUEL	F	49:07N	123:04W	157	BRITISH COLUMBIA, CANADA
213	26	11	77	TEXAS ON 523761 (BARGE)	B	USA	0	0	0	UNSP	272	272	272	2	NO. 2/4 FURNACE OIL	T	30:00N	090:03W	118	NEW ORLEANS, LA MISS. R. MI. 95.4

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
214	4	12	77	TEXACO BRISBANE	T	BRI	50,000	0	61		997	997	997	2	BUNKER FUEL	F	UNSP	UNSP	25	NEAR BORNEO
215	16	12	77	VENOIL	T	LIB	330,954	152,327	73	FULL	23,216	18,790	23,216	1	IRANIAN CRUDE	F	34:25S	024:05E	441	32 KM OFF SOUTH AFRICA
216	16	12	77	VENPET	T	LIB	330,869	330,869	73	BALLAST	3,264	2,648	3,264	2	BUNKER	F	34:25S	024:05E	441	32 KM OFF SOUTH AFRICA
217	20	12	77	GOLDEN EAGLE	T	UNS	0	0	0	UNSP	175	175	175	2	FURNACE OIL	F	47:10N	055:09W	150	NEWFOUNDLAND, CANADA
218	23	12	77	NICOS I VARDINOYANNIS	T	GRE	134,700	0	71	FULL	599	221	599	1	CRUDE OIL	F	53:32N	008:07E	216	WILHELMSHAVEN, WEST GERMANY
219	4	1	78	TAKASE MARU	T	JAP	231,000	0	70		2,993	2,993	2,993	1	CRUDE	F	UNSP	UNSP	0	COAST OF OMAN, PERSIAN GULF
220	9	1	78	BOUCHARD NO. 100 (BARGE)	B	USA	0	0	0	UNSP	680	680	707	2	NO. 1-D/2 FUEL	T	40:55N	073:24W	152	LONG ISLAND SOUND, NY
221	10	1	78	BRAZILIAN MARINA	T	LIB	319,226	150,518	76	UNSP	35,310	11,856	35,310	1	CRUDE	F	23:48S	045:43W	376	SAO SEBASTIAO, BRAZIL
222	10	1	78	CHRISSI	T	GRE	2,000	1,427	44	FULL	1,496	1,496	1,496	2	FUEL OIL	F	37:57N	023:35E	142	PSITTALIA I., MEDITER. SEA, GREECE
223	11	1	78	PAVLOS V	T	GRE	27,000	15,861	51	BALLAST	499	499	499	2	BUNKER FUEL	F	38:02N	012:30E	143	MEDITERR. SEA, OFF W TIP OF SICILY
224	19	1	78	JAPAN GALATHUS	T	JAP	209,000	0	70		29,932	29,932	29,932	1	CRUDE	F	UNSP	UNSP	0	PERSIAN GULF
225	23	1	78	BAYOU WILLOW (BARGE)	B	UNS	0	0	0	UNSP	163	162	163	2	NO. 6 FUEL	T	29:30N	094:52W	82	GALVESTON BAY, TEXAS
226	27	1	78	IKUYO MARU	T	JAP	258,000	0	72		19,864	19,864	19,864	1	CRUDE	F	UNSP	UNSP	0	PERSIAN GULF
227	31	1	78	DOMAR 6501 (BARGE)	B	USA	1,000	0	0		816	713	898	1	CRUDE OR NO. 6 FUEL	T	29:14N	091:30W	82	POINT AU FER, LA, ATCHAFALYA BAY
228	6	2	78	GIM 200 (BARGE)	B	USA	0	0	0		499	499	499	2	FUEL OIL	T	UNSP	UNSP	81	GULF OF MEXICO, ALABAMA
229	6	2	78	CHOTIN 2546 (BARGE)	B	USA	0	0	0	UNSP	218	218	218	1	NAPHTHA INDIAN CRUDE	T	30:37N	088:02W	117	MOBILE BAY, ALABAMA
230	6	2	78	GLOBAL HOPE	T	GRE	39,000	22,944	60	BALLAST	499	130	499	2	FUEL OIL	T	42:31N	070:50W	152	SALEM SOUND, MASSACHUSETTS
231	9	2	78	BROLAND	T	BRI	31,101	0	0	UNSP	194	174	194	2	GASOLINE: AUTOMOTIVE	T	40:33N	074:14W	152	PORT READING, NEW JERSEY
232	17	2	78	MARIA THERESA	T	GRE	20,000	0	58		499	499	499	2	FUEL OIL	F	UNSP	UNSP	102	GULF OF OMAN, PAKISTAN
233	22	2	78	CASSIOPEIA	T	GRE	28,000	16,400	73	BALLAST	997	997	997	2	BUNKER FUEL	F	12:49N	073:05W	44	CARRIBEAN SEA, COLUMBIA
234	23	2	78	SAN MARCO	T	PAN	5,047	2,917	71	PARTIAL	816	816	816	1	CRUDE	F	05:30N	100:28E	27	STRAIT OF MALACCA, PENANG
235	16	3	78	AMOCO CADIZ	T	LIB	233,690	109,700	73	FULL	220,279	211,091	222,442	1	LIGHT ARABIAN CRUDE	F	48:35N	004:43W	145	OFF PORTSALL, BRITTANY NWEST FRANCE
236	16	3	78	OCEAN 250 (BARGE)	B	USA	5,000	0	0	UNSP	2,211	1,995	2,211	2	GASOLINE: AVIATION	T	41:17N	071:51W	152	BLOCK ISLAND SOUND, RI
237	20	3	78	INTERSTATE 19 (BARGE)	B	USA	0	1,098	48	FULL	2,041	2,041	2,041	2	JP-5 AVIATION/KEROSE	T	39:35N	075:35W	116	DELAWARE BAY, DE
238	22	3	78	AEGIS LEADER	T	GRE	87,055	40,709	66	BALLAST	502	502	2,041	2	FUEL OIL/BUNKER	F	06:03N	095:06E	27	OFF SUMATRA
239	30	3	78	MARY (BARGE)	B	USA	0	0	0	UNSP	136	136	136	2	NO. 6 FUEL	T	30:00N	090:03W	118	NEW ORLEANS, LA MISS. R. MI. 118.6
240	2	4	78	SEALIFT MEDITERRANEAN	T	USA	27,217	0	74	FULL	3,156	3,156	3,490	2	SPECIAL NAVAL FUEL	F	03:30N	102:00E	26	RONDO ISLAN,D STRAIT OF MALACCA
241	7	4	78	ASTRON	T	PAN	46,000	26,947	57	BALLAST	997	997	997	2	BUNKER FUEL	F	18:44N	068:27W	43	20 MI. NW CABO ENGANO LIGHT-DOM REP
242	18	4	78	OKTAVIUS	T	SWE	31,000	0	73		499	499	499	2	FUEL OIL	F	UNSP	UNSP	215	BALTIC SEA, SWEDEN
243	22	4	78	NO. 102 (BARGE)	B	USA	0	0	0		680	598	680	2	LIGHT DIESEL NO. 2	T	38:40N	090:15W	118	ST. LOUIS, MO UPPER MISS. R. 168.5
244	2	5	78	MISSISSIPPI (BARGE)	B	USA	0	0	0		402	402	402	2	GASOLINE REFORMATES	T	UNSP	UNSP	154	MI. 730.5 UPPER MISS. R. MINNESOTA
245	6	5	78	ELENI V.	T	GRE	18,879	12,680	58	FULL	2,390	997	4,986	2	HEAVY FUEL OIL	F	52:49N	001:48E	216	NORTH SEA, NORFOLK, ENGL.
246	17	5	78	ATHENIAN VICTORY	T	GRE	28,000	0	58		499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	68	GULF OF ADEN, DJIBOUTI
247	26	5	78	AMINONA	T	GRE	21,000	13,124	59	FULL	19,946	19,946	19,946	2	GASOLINE	F	02:18S	044:13W	304	ATLANTIC O., BANCO DO MEIO, BRAZIL
248	26	5	78	WORLD HORIZON	T	LIB	224,000	0	72		707	707	707	1	CRUDE	F	UNSP	UNSP	0	AFRICAN/INDIAN OCEAN
249	26	5	78	ROLLNES	T	UNS	5,883	0	0	UNSP	275	275	275	2	GASOLINE	T	30:40N	088:05W	117	MOBILE, ALABAMA
250	9	6	78	ROLLNER (MV)	T	UNS	0	0	0	UNSP	233	233	233	0	UNSPECIFIED	T	UNSP	UNSP	0	USA
251	12	6	78	TSHOKU SEKIYU	T	UNS	0	0	0	UNSP	2,820	2,820	2,820	0	UNSPECIFIED	F	38:19N	141:00E	130	SHIOGAMA, INLAND JAPAN
252	7	7	78	CABO TAMAR	T	CHI	62,243	35,097	64	FULL	6,179	6,179	19,946	1	CRUDE	F	36:40S	073:10W	415	SAN VICENTE BAY, CHILE
253	0	8	78	OVERSEAS JOYCE	T	USA	49,842	0	0	FULL	247	247	247	1	CRUDE	F	08:57N	079:33W	8	BALBOA CHANNEL, PANAMA
254	8	8	78	KANSAS (BARGE)	B	USA	0	0	0		259	259	259	2	GASOLINE: AUTOMOTIVE	T	UNSP	UNSP	117	OHIO RIVER MI. 877.0, KY
255	11	8	78	KOUNTOURIOTIS	T	GRE	64,000	35,658	64	FULL	4,986	4,986	4,986	2	BUNKER FUEL	F	04:52N	098:03E	27	STR. OF MALACCA, SUMATRA
256	20	8	78	IDAN	T	GRE	52,000	27,383	60	BALLAST	997	997	997	2	BUNKER FUEL	T	27:46N	092:19W	82	GULF OF MEXICO, S. OF LOUSIANA
257	21	8	78	THEOPAES	T	GRE	34,139	20,621	60	UNSP	176	176	590	1	CRUDE	F	16:48N	069:00W	43	290 KM SW OF SAN JUAN, PR
258	23	8	78	NORDIC CLANSMAN	T	BRI	268,235	0	0		149	149	149	1	CRUDE	F	49:42N	000:10E	180	C. D'ANTIFER, FRANCE
259	2	9	78	RYOKA MARU 101 (BARGE)	B	JAP	1,000	996	74	FULL	997	997	997	2	GASOLINE	F	37:00N	141:00E	133	PACIFIC O., OFF HONSHU JAPAN
260	25	9	78	KOKKO MARU	T	JAP	238,000	0	73		2,041	2,041	2,041	1	CRUDE	F	UNSP	UNSP	0	GULF OF OMAN
261	4	10	78	LITIOPIA	T	BRI	311,900	0	0	UNSP	254	236	254	1	KUWAIT CRUDE	F	53:25N	004:20W	181	AMLWCH, WALES, UK
262	12	10	78	CHRISTOS BITAS	T	GRE	58,829	30,408	63	PARTIAL	3,718	988	4,986	1	IRANIAN CRUDE	F	51:43N	005:40W	181	7 KM OFF WALES, UK
263	18	10	78	EKFORS	T	SWE	6,799	0	0		149	149	149	2	LIGHT DIESEL	F	55:55N	014:20E	215	BALTIC SEA OFF AHUS, SWEDEN
264	21	10	78	LIMA	T	BRI	319,000	0	77		6,939	6,939	6,939	1	CRUDE	F	UNSP	UNSP	0	PORT, S.W. AFRICA, NIGERIA
265	27	10	78	GEORGE WHITLOCK 2 (BARGE)	B	USA	1,000	0	69		598	598	598	2	GASOLINE	T	UNSP	UNSP	151	ATLANTIC O., NEW YORK
266	7	11	78	FEOSO SUN	T	PAN	21,000	13,186	60	EMPTY	997	997	997	2	BUNKER FUEL	F	14:31N	120:37E	60	MANILA BAY, PHILLIPINES
267	12	11	78	MARA	T	VEN	46,000	26,313	58	PARTIAL	9,973	9,973	9,973	2	FUEL OIL	F	12:00N	068:00W	43	CARIBBEAN,8 MI CURACAO, NETHERLANDS
268	28	11	78	CIBRO PHILADELPHIA(BARGE)	B	UNS	0	0	0	UNSP	144	144	152	2	NO. 2-D FUEL	T	40:47N	073:56W	152	NEW YORK HARBOR, NY
269	7	12	78	TADOTSU	T	LIB	132,000	0	72		39,864	39,864	39,864	1	CRUDE	F	UNSP	UNSP	0	GULF OF OMAN
270	8	12	78	ROBERT L. POLING (BARGE)	B	USA	0	0	0	UNSP	162	162	162	2	UNLEADED GASOLINE	T	40:34N	074:01W	152	GRAVESEND BAY, NY
271	19	12	78	PECK SLIP (BARGE)	B	USA	20,000	5,896	72	FULL	1,497	1,497	1,633	1	BUNKER C/FUEL	T	18:03N	065:50W	43	CAPE SAN JUAN, PR
272	25	12	78	KOSMAS M	T	GRE	20,000	12,360	57	FULL	9,973	9,973	9,973	2	FUEL OIL	F	40:05N	027:00E	178	AKBAS NR.CANAKKALE,DARDANELLES,TUR
273	30	12	78	ESSO BERNICIA	T	BRI	193,658	0	68	UNSP	898	898	1,004	2	BUNKER C/FUEL OIL	F	60:27N	001:20W	217	SHETLAND ISLAND, UK
274	31	12	78	ANDROS PATRIA	T	GRE	218,665	99,460	70	FULL	47,210	46,872	47,295	1	IRANIAN CRUDE	F	43:31N	009:37W	145	BAY OF BISCAY,CAPE FINISTERRE,SPAIN
275	2	1	79	MASTER MICHAEL	T	CYP	5,588	3,664	59	FULL	5,695	5,585	5,695	2	DIESEL FUEL	F	15:10N	072:10W	44	CARIBBEAN SEA BTW HAITI-VENEZ.
276	8	1	79	BETELGEUSE	T	FRE	121,430	61,766	68	PARTIAL	26,864	26,680	27,924	1	LIGHT ARABIAN CRUDE	F	51:41N	009:30W	181	BANTRY BAY, IRELAND
277	11	1	79	TRADE NOMAD	T	GRE	68,590	0	0	UNSP	231	192	246	2	COAL TAR CARBON BLKF	T	30:10N	091:11W	118	WHITE CASTLE, LA MISS. R. MI. 199.0
278	20	1	79	THUNTANK 3	T	SWE	4,474	2,531	70	UNSP	351	351	499	2	HEAVY FUEL OIL	F	55:53N	010:51E	215	SAMSO ISL. GREAT BELT, DENMARK
279	26	1	79	GEFO KOLN	T	WGE	0	0	0		1,182	1,088	1,182	2	JP-1 AVIATION/KEROSE	F	51:55N	004:29E	216	ROTTERDAM, NETHERLANDS
280	28	1	79	ESSO BAYWAY	T	LIB	50,111	22,697	78	FULL	859	781	997	1	LIGHT ARABIAN CRUDE	T	30:00N	093:59W	118	NECHES RIVER, TEXAS
281	5	2	79	B. NO. 105 (BARGE)	B	USA	0	0	0		253	253	253	2	NO. 6 FUEL	T	40:42N	073:58W	151	NEAR PERTH AMBOY, NY
282	6	2	79	AMOCO CREMONA	T	LIB	73,982	0	0		155	155	156	2	BUNKER C NO. 6 FUEL	T	29:22N	094:53W	82	TEXAS CITY, TEXAS
283	18	2	79	REB 192 (BARGE)	B	USA	0	1,186	0	UNSP	259	259	259	2	CARBON BLK FEEDSTOCK	T	29:41N	091:13W	82	BERWICK, LA
284	26	2	79	GULFOIL	T	USA	29,708	0	0	UNSP	218	218	248	2	GASOLINE: AUTOMOTIVE	T	29:43N	093:52W	82	PORT ARTHUR, TEXAS

11-Mar-92

Spill Inventory for January 1, 1974 to December 31, 1982

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
285	27	2	79	ANTONIO GRAMSCI	T	RUS	40,000	0	78	UNSP	4,217	4,217	4,986	1	CRUDE	F	57:24N	021:32E	214	OFF VENTSPILS LATVIA, USSR
286	27	2	79	CIELO ROSSO	T	ITA	20,016	0	59	FULL	383	356	499	2	GASOIL/FUEL OIL	F	57:45N	012:00E	215	THE KATTEGAT, SWEDEN
287	0	3	79	SIMONBURN	T	BRI	32,017	0	0	FULL	10,883	10,883	10,883	2	NO. 6 FUEL	F	46:56N	059:40W	150	65 KM NE OF SYDNEY, NOVA SCO.
288	0	3	79	ZAMORA	T	ECU	35,109	0	0	UNSP	228	228	228	1	CRUDE	F	30:12N	088:00W	117	MOBILE HARBOR, ALABAMA
289	0	3	79	PASADENA	T	LIB	96,585	0	0	FULL	2,207	2,207	2,207	0	UNSPECIFIED	F	31:00N	032:15E	141	SUEZ CANAL, EGYPT
290	1	3	79	SKYRON II	T	LIB	98,131	0	67	FULL	2,648	2,493	2,964	1	CRUDE	F	31:00N	032:15E	141	KM 155, SUEZ CANAL, EGYPT
291	2	3	79	MESSINIAKI FRONTIS	T	LIB	155,250	0	77	FULL	14,164	14,164	49,884	1	LIBYAN CRUDE	F	34:55N	024:48E	142	2 KM OFF CRETE KALOI LIMENES
292	4	3	79	GREY HUNTER	T	BRI	123,964	67,202	74	FULL	758	758	1,995	1	CRUDE & BUNKER	F	36:06N	005:21W	144	POINT EUROPA, GIBRALTAR
293	4	3	79	NETTE THERESA	T	DAN	0	499	0	UNSP	205	205	207	2	GASOIL	F	55:27N	009:43E	216	LITTLE BELT, DENMARK
294	11	3	79	SEA VALIANT	T	LIB	79,373	0	65	FULL	1,501	1,501	1,695	1	CRUDE	F	40:00N	028:00W	147	N. ATL. 808 MI. N. OF AZORES
295	15	3	79	KURDISTAN	T	BRI	32,531	0	73	UNSP	14,966	12,731	14,966	2	BUNKER C/NAPTHA	F	46:55N	059:39W	150	CABOT STRAIT, N. SCOTIA,CANADA
296	17	3	79	STCO-228 (BARGE)	B	USA	0	0	0	FULL	544	272	544	2	UNLD GASOLINE: AVIA	T	29:22N	094:51W	82	TEXAS CITY, TEXAS
297	19	3	79	LIGHTCANSO	T	UNS	0	0	0	UNSP	784	784	823	2	NO. 2 DIESEL FUEL	F	45:19N	060:55W	151	STRAIT OF CANSO, NOVA SCOTIA
298	22	3	79	MIYA MARU NO. 8	T	JAP	2,183	0	0	FULL	463	463	499	1	MINAS HEAVY CRUDE	F	34:22N	133:51E	131	SAKAI, JAPAN
299	30	3	79	INEZ 2	T	BEL	4,000	0	73		1,197	1,197	1,197	2	NAPHTHA	F	UNSP	UNSP	216	NORTH SEA, NETHERLANDS
300	5	4	79	FORTUNE	T	LIB	99,009	0	73	FULL	8,846	8,846	9,973	1	KUWAIT CRUDE	F	01:30N	104:36E	26	88 KM NE OF SINGAPORE
301	12	4	79	CROWLEY MARIT. 101 (BARGE)	B	USA	0	721	0	UNSP	136	136	136	2	HIGH OCTANE GAS	T	37:55N	122:25W	121	SAN FRANCISCO BAY, CA
302	17	4	79	CHOTIN 3291 (BARGE)	B	USA	988	0	0		272	272	272	2	NO. 6 FUEL OIL	T	36:11N	089:40W	117	CARUTHERSVILLE, MISSOURI, MISS. R.
303	18	4	79	AURIGA PRIMO	T	ITA	52,000	0	0		1,088	1,088	1,088	1	CRUDE	F	UNSP	UNSP	0	PORT BLACK SEA BOSPHOROUS STRAIT
304	18	4	79	M-608 (BARGE)	B	USA	0	0	0		231	230	231	2	DIESEL NO. 2 FUEL	T	30:00N	090:03W	118	NEW ORLEANS, LA MISS. R. MI. 107.0
305	28	4	79	GINO	T	LIB	50,000	26,167	69	FULL	41,886	41,886	41,886	2	CARBON BLACK FEEDSTK	F	48:17N	005:40W	145	40 MI. OFF COAST OF BRITTANY,FRANCE
306	0	5	79	PUERTO RICAN	T	USA	0	0	0	UNSP	184	184	184	2	ETHYL-GLYCOL	T	30:00N	094:00W	118	SABINE/NECHES INT. LA
307	0	5	79	BARGE 8	B	BRI	0	0	0		993	993	993	1	CRUDE	F	UNSP	UNSP	0	HONG KONG, ANCHORED NEAR COASTLINE
308	5	5	79	MOBIL 322 (BARGE)	B	USA	0	1,397	0		200	200	272	2	NO. 1-D FUEL	T	37:12N	089:26W	117	THEBES, IL UPPER MISS. R. MI. 43.7
309	8	5	79	POTOMAC	T	USA	0	0	0	UNSP	318	318	318	2	BUNKER C	F	UNSP	UNSP	185	GREENLAND
310	26	5	79	(TANK SHIP)	T	UNS	0	0	0		229	229	229	1	CRUDE	T	35:43N	088:03W	117	TENNESSEE R., TN
311	27	5	79	ATLAS TITAN	T	LIB	213,000	91,963	69	EMPTY	997	997	997	2	BUNKER FUEL	F	38:50N	009:00W	109	SETUBAL, PORTUGAL
312	12	6	79	MARIHERON	T	PAN	20,000	12,281	59	BALLAST	499	499	499	2	BUNKER FUEL	F	02:54S	104:54E	325	MUSI R., PALEMBANG, SUMATRA
313	13	6	79	BOMIN 2	T	SIN	19,000	0	58		997	997	997	2	NAPHTHA	F	UNSP	UNSP	216	NORTH SEA, SCOTLAND
314	21	6	79	PETRO ROUSCAT	T	FRE	1,000	0	51		598	598	598	2	FUEL OIL	F	UNSP	UNSP	1	RIVER IN CAMEROON, W. AFRICA
315	24	6	79	ZEPHYROS	T	GRE	64,000	32,721	64	BALLAST	997	997	997	2	BUNKER FUEL	F	26:17N	055:18E	103	PERSIAN GULF, TURB I., IRANIAN WAT
316	25	6	79	INTERSTATE 50 (BARGE)	B	USA	0	0	0		612	612	612	1	CRUDE	T	39:48N	075:25W	116	DELEWARE? R. NEAR PHILADELPHIA, PA
317	26	6	79	VERA BERLINGIERI	T	ITA	7,220	4,942	60	FULL	10,032	5,186	10,032	2	GASOLINE DIESEL FUEL	F	41:46N	012:14E	179	18 MI (30 KM) OFF FIUMICINO, ITALY
318	26	6	79	ASTORIA	T	GRE	59,032	0	64	FULL	2,322	1,197	2,592	1	RUSSIAN CRUDE	F	53:23N	007:13E	216	EMDEN, WEST GERMANY
319	28	6	79	AVILES	T	LIB	0	15,410	66	FULL	10,080	10,080	22,449	2	KEROSENE JET FUEL	F	13:00N	068:36E	66	280 MI. NW COCHIN, ARABIAN SEA, INDIA
320	19	7	79	AEGEAN CAPTAIN	T	LIB	210,257	92,682	68	FULL	13,962	19,763	19,763	1	VENEZUELAN CRUDE	F	11:19N	060:31W	42	30 KM NE TRINIDAD-TOBAGO
321	19	7	79	ATLANTIC EMPRESS	T	GRE	292,666	128,399	74	FULL	138,335	138,335	275,249	1	ARABIAN CRUDE	F	11:19N	060:31W	42	30 KM NE TRINIDAD-TOBAGO
322	24	7	79	CHASTINE MAERSK	T	DAN	14,169	0	0	UNSP	149	149	149	0	UNSPECIFIED	F	29:20N	048:00E	104	KUWAIT, KUWAIT
323	28	7	79	AL SOREYA	T	BRI	1,000	0	65		698	698	698	2	FUEL OIL	F	UNSP	UNSP	0	PERSIAN GULF, ABU DHABI
324	2	8	79	ATLANTIC EMPRESS	T	GRE	292,666	128,399	74	FULL	134,383	134,383	134,383	1	ARABIAN CRUDE	F	13:05N	055:28W	42	450KM EAST OF BARBADOS
325	11	8	79	FORTUNA	T	HON	1,000	0	66		997	997	997	2	FUEL OIL	F	UNSP	UNSP	25	REEF, S. CHINA SEA?, BORNEO
326	16	8	79	IOANNIS ANGELICOUSSIS	T	GRE	67,000	35,269	64	PARTIAL	29,932	29,932	30,916	1	CRUDE	F	06:01S	011:42E	334	CABINDA GULF OIL, MALONGO, ANGOLA
327	18	8	79	WORLD PROTECTOR	T	GRE	31,095	0	74	FULL	638	536	69,810	2	FURNACE OIL	F	18:56N	072:51E	65	BOMBAY HARBOR, INDIA
328	26	8	79	PATIANNA	T	LIB	48,000	23,760	71	PARTIAL	1,496	1,496	1,496	2	BUNKER FUEL	F	UNSP	UNSP	0	PERSIAN, 7 MI. OFF DUBAI, UAE
329	27	8	79	CHERRY DUKE	T	SIN	29,000	17,875	56	BALLAST	997	997	997	2	BUNKER FUEL	F	25:02N	053:10E	103	17 MI. OFF DAS I., PERSIAN GULF
330	1	9	79	CHEVRON HAWAII	T	USA	71,339	35,588	73	PARTIAL	2,721	2,041	4,986	1	CRUDE & GASOLINE	T	29:44N	095:08W	82	DEER PARK, HOUSTON, TEXAS
331	16	9	79	DEVALI I	T	LIB	59,000	0	64		993	993	993	1	CRUDE	T	UNSP	UNSP	0	AMERICAN ATLANTIC SANTO DOMINGO
332	18	9	79	GOLDEN SUN	T	HON	1,000	0	63		798	798	798	2	FUEL OIL	F	UNSP	UNSP	25	S. CHINA SEA?, BORNEO
333	18	9	79	CAPTAIN BRISCOE (BARGE)	B	UNS	0	0	0		218	218	218	2	MINERAL OIL	T	UNSP	UNSP	117	OHIO R. MI. 787.0, KY
334	20	9	79	YANXILAS	T	GRE	50,710	28,601	65	FULL	176	176	499	1	CRUDE & GASOIL	F	55:20N	011:03E	215	GREAT BELT, DENMARK
335	0	10	79	TITIPOR	T	GRE	31,500	0	0	UNSP	21,497	21,497	21,497	2	DIESEL FUEL	F	03:06S	060:00W	305	TOMANAUS ROADS, BRAZIL
336	2	10	79	DELSAN 1	T	PHI	1,000	0	58		997	997	997	2	GASOLINE	F	UNSP	UNSP	60	PACIFIC O.?, PHILIPPINES
337	5	10	79	CYS DIGNITY	T	LIB	89,999	43,430	75	FULL	5,928	5,928	14,959	1	CRUDE	F	11:02N	064:29W	43	OFF ISLA DE MARGARITA, VENEZUELA
338	19	10	79	BETTY (BARGE)	B	USA	0	0	0		207	207	207	2	NO. 6 FUEL	T	UNSP	UNSP	118	ARKANSAS R. MI. 116.0, AR
339	27	10	79	GUNVOR MAERSK	T	DEN	32,000	19,922	63	PARTIAL	14,959	14,959	14,959	2	FUEL OIL	F	03:00S	060:00W	306	AMAZON R., MANAUS ROADS, BRAZIL
340	1	11	79	BURMAH AGATE	T	LIB	61,674	32,286	63	FULL	34,661	34,661	39,891	1	NIGERIAN LIGHT CRUDE	T	29:17N	094:48W	82	4 MI. FR ENTR. GALVESTON BAY, TEXAS
341	4	11	79	PALVA	T	FIN	17,000	0	64		499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	148	MID-ATLANTIC
342	10	11	79	MOBIL SERVICE 2	T	SIN	2,000	0	61		1,496	1,496	1,496	2	FUEL OIL	F	UNSP	UNSP	27	STRAIT OF MALACCA
343	15	11	79	INDEPENDENTA	T	RUM	150,001	88,690	78	FULL	93,576	93,576	94,343	1	LIBYAN CRUDE	F	41:02N	028:57E	178	BOSPORUS STRAIT, ISTANBUL, TURKEY
344	22	11	79	HITRA	T	NOR	38,000	0	61		1,496	1,496	1,496	2	FUEL OIL	F	UNSP	UNSP	0	N. SEA, WEST GERMANY
345	3	12	79	CELTIC LEE	T	BRI	1,000	501	60	FULL	499	499	499	2	FUEL OIL	F	51:50N	008:00W	181	LEE RIVER AT CORK, IRELAND
346	12	12	79	TINE	T	GRE	2,200	0	0	UNSP	236	233	236	2	GASOIL	F	55:20N	011:03E	215	HALLSKOV, GREAT BELT, DENMARK
347	13	12	79	ENERGY DETERMINATION	T	LIB	321,186	153,480	76	BALLAST	4,986	4,986	4,986	2	BUNKER FUEL	F	26:37N	056:28E	103	STR. OF HORMUZ, 40 MI-RAS AL KHAIMAH
348	15	12	79	TURGUT REIS	T	TUR	18,594	12,095	54	FULL	233	233	17,959	2	GASOIL/FUEL OIL	F	45:05N	007:50W	145	105 MI (170 KM) N LA CORUNA, SPAIN
349	19	12	79	DONAU MARU	T	JAP	76,850	0	69	UNSP	810	810	952	2	NO. 6 FUEL/NAPTHA	T	42:21N	071:02W	152	BOSTON, MASSACHUSETTS
350	19	12	79	PINA	T	LIB	55,605	29,004	66	UNSP	544	544	3,989	1	CRUDE	T	30:00N	090:03W	118	NEW ORLEANS, LA
351	21	12	79	CHOYO MARU	T	JAP	76,000	46,092	66	BALLAST	997	997	997	2	BUNKER FUEL	F	07:45S	115:09E	324	17 MI. N. OF BALI I., FLORES SEA
352	16	1	80	SALEM (DELIBERATELY SUNK)	T	LIB	214,000	96,228	69	FULL	15,918	15,918	15,918	1	KUWAITI CRUDE	F	12:38N	018:34W	38	ATLANTIC O, S OF GAMBIA, W. AFRICA
353	17	1	80	NEW YORK (BARGE)	B	USA	0	14,187	0		224	224	224	2	GASOLINE: AV & AUTO	T	25:06N	080:06W	81	FORT LAUDERDALE, FLORIDA
354	28	1	80	PRINCESS ANNE-MARIE	T	GRE	70,271	0	64	FULL	3,887	3,887	11,967	1	CRUDE & FUEL	F	21:50N	084:40W	81	CABO SAN ANTONIO, CUBA
355	30	1	80	DELSAN 2	T	PHI	1,000	0	62		499	499	499	2	GASOLINE	F	UNSP	UNSP	0	PACIFIC O.?, REEF OFF PHILLIPINES

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
356	7	2	80	LAKE ANJA	T	NOR	21,113	0	0	UNSP	988	988	988	2	TALLOW	F	50:00N	002:00W	181	ENGLISH CHANNEL, UK
357	23	2	80	IRENES SERENADE	T	GRE	105,460	50,904	65	FULL	118,562	99,728	118,562	1	LIBYAN CRUDE	F	36:55N	021:42E	142	NAVARINO BAY, OFF PILOS, GREECE
358	23	2	80	OCEAN CITIES (BARGE)	B	USA	0	0	0	FULL	680	598	680	2	GASOLINE: AVIATION	T	27:17N	092:40W	82	GULF OF MEXICO, LA (12-200 MI.)
359	25	2	80	KARAHASAN	T	TUR	1,000	0	62		798	798	798	2	GASOLINE	F	UNSP	UNSP	178	BLACK SEA/BOSPHORUS, TURKEY
360	26	2	80	SOUTHWEST CAPE	T	LIB	44,214	0	0	UNSP	816	816	816	2	NO. 6 FUEL	T	40:31N	074:17W	152	OFF PERTH AMBOY, NJ
361	5	3	80	ETHEL H. (BARGE)	B	USA	8,000	3,872	0	FULL	373	373	499	2	NO. 6 FUEL	T	40:31N	074:17W	152	PERTH AMBOY, NJ
362	7	3	80	TANIO	T	PAN	27,500	18,048	58	FULL	13,463	6,939	18,450	2	HIGH SULFUR FUEL OIL	F	49:10N	004:16W	145	60 KM OFF BRITTANY, FRANCE
363	11	3	80	MARIA ALEJANDRA	T	SPA	243,000	122,599	77	BALLAST	3,989	3,989	3,989	2	BUNKER FUEL	F	20:32N	018:13W	74	ATLANTIC O., OFF MAURITANIA,WAFRICA
364	15	3	80	CALIFORNIA GETTY	T	LIB	131,000	0	68		490	490	490	1	CRUDE	F	UNSP	UNSP	0	PORT IN PERSIAN GULF
365	15	3	80	BRIMSTONE (BARGE)	B	USA	0	0	0		1,224	1,224	1,361	1	CRUDE	T	30:00N	090:12W	118	KENNER, LOUSIANA
366	16	3	80	HBL 3011 (BARGE)	B	USA	0	468	0		1,224	1,224	1,224	1	CRUDE	T	30:00N	090:12W	118	KENNER, LA LOWER MISS. R. MI. 112.0
367	29	3	80	ARTEMIS	T	GRE	90,374	0	57	UNSP	496	496	496	1	CRUDE	F	31:03N	032:19E	141	SUEZ CANAL, KM 24, EGYPT
368	3	4	80	ALBAHAA B	T	LIG	239,410	109,465	71	BALLAST	3,989	3,989	3,989	2	BUNKER FUEL	F	07:00S	045:00E	331	200 MI OFF DAR-ES-SALAAM, TANZANIA
369	4	4	80	MYCENE	T	LIG	238,889	109,992	76	BALLAST	3,989	3,989	3,989	2	BUNKER FUEL	F	07:42N	015:10W	2	OFF SIERRA LEONE, W. AFRICA
370	6	4	80	MOBILE (BARGE)	B	USA	0	0	0		259	259	259	2	GASOLINE: AVIATION	T	UNSP	UNSP	153	OHIO RIVER MI. 918.6, KY
371	16	4	80	(BARGE)	B	USA	0	0	0		136	136	136	2	KEROSENE	T	29:25N	095:16W	82	ALVIN, TEXAS
372	27	4	80	HAN CHEONG	T	KOR	0	0	57	UNSP	1,296	1,296	1,296	2	RANGE OIL	T	07:14N	134:28E	23	PALAU ISLANDS, GUAM PACIFIC OCEAN
373	29	4	80	STCO 227 (BARGE)	B	USA	0	0	0		544	544	616	2	CUT. FEEDSTOCK RANGE	T	29:43N	095:01W	82	BAYTOWN, TEXAS
374	15	5	80	NITTAN MARU 3	T	JAP	3,719	0	0	UNSP	221	133	221	2	BLACK OIL	F	33:57N	131:16E	131	UBE, JAPAN
375	26	5	80	NELY P	T	GRE	21,000	0	57		499	499	499	2	FUEL OIL	F	UNSP	UNSP	179	MEDITERRANEAN SEA OFF ITALY
376	3	6	80	FURENAS	T	SWE	2,100	834	0	UNSP	201	201	201	2	FUEL OIL	F	56:00N	000:13E	216	ORESUND STRAIT, DEN/SWE
377	7	6	80	TEXACO CONNECTICUT	T	USA	42,000	0	53	UNSP	551	551	5,485	1	ALASKAN CRUDE	F	09:08N	079:42W	8	GAMBOA, PANAMA CANAL ZONE
378	6	7	80	ZAVYETY.ILYICHA	T	RUS	20,000	0	70		19,864	19,864	19,864	1	CRUDE	F	UNSP	UNSP	0	INDIAN OCEAN
379	26	7	80	EXXON HOUSTON	T	USA	71,000	34,851	65	FULL	389	389	499	2	NO. 2 FUEL	T	29:00N	089:00W	81	OFF SW PASS, MOUTH OF MISS. R.
380	0	8	80	GREMONA	T	SPA	0	92,345	0	UNSP	913	913	913	2	BUNKER C	F	26:12N	050:38E	103	BAHRAIN, ARABIAN GULF
381	21	8	80	TEXACO NORTH DAKOTA	T	USA	19,000	12,789	53	PARTIAL	2,449	2,449	8,435	2	RAFFINATE/GASOLINE	T	28:04N	091:39W	82	100 MI SOUTH OF MORGAN CITY, LA
382	21	8	80	HOSEI MARU	T	JAP	2,075	983	0	UNSP	249	249	249	2	HEAVY FUEL OIL	F	38:54N	141:34E	130	KESENNUMA, JAPAN
383	9	9	80	DERBYSHIRE	T	BRI	0	91,654	76	UNSP	7,146	7,146	7,146	2	FUEL OIL/BUNKER	F	25:50N	133:30E	95	880 KM ESE OKINAWA, JAPAN
384	17	9	80	(BARGE)	B	UNS	0	0	0	UNSP	177	177	178	1	CRUDE	T	29:48N	092:10W	82	INTRACOASTAL WATERWAY, LA
385	27	9	80	(BARGE)	B	UNS	0	0	0	UNSP	136	136	136	2	FUEL OIL	F	12:58S	038:29W	339	SALVADOR, BRAZIL
386	2	11	80	SUFFOLK (BARGE)	B	USA	0	2,996	0	UNSP	373	65	373	2	NO. 6 FUEL	T	40:39N	074:08W	152	BAYONNE, NJ
387	8	11	80	STAWANDA	T	GRE	29,840	0	0	UNSP	639	639	707	2	KEROSENE/GASOLINE	F	40:30N	026:50E	178	STRAIT OF BOSPORUS, TURKEY
388	8	11	80	NORDIC FAITH	T	BRI	81,145	0	0	UNSP	648	648	648	2	KEROSENE	F	40:30N	026:50E	178	STRAIT OF BOSPORUS, TURKEY
389	11	11	80	PNOC TRANSMAR	T	PHI	2,000	920	70	FULL	1,496	1,496	1,496	2	BUNKER OIL	F	15:00N	122:00E	60	PACIFIC O., LUZON, PHILLIPINES
390	20	11	80	NAKATA ELEVEN	T	JAP	0	0	0	UNSP	334	334	334	2	KEROSENE	F	06:10N	001:21E	36	LOME, TOGO
391	21	11	80	CHRISTIAN F. REINAUER	T	USA	2,286	0	47	FULL	324	324	499	2	NO. 2 FUEL GASOLINE	T	44:00N	069:10W	151	METINIC ISLAND, MAINE
392	22	11	80	GEORGIA	T	NOR	127,000	0	77	FULL	4,354	3,989	4,354	1	LIGHT CRUDE	T	29:10N	089:15W	81	PILOTTOWN, LA LOW. MISS.R. MI. 0.2
393	4	12	80	VALNY	T	PAN	18,000	0	53		499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	105	RED SEA OFF EGYPT
394	24	12	80	TT-7002 (BARGE)	B	USA	2,000	1,710	0	FULL	449	447	499	2	FUEL/GASOIL: CRACKED	T	30:02N	094:02W	118	BEAUMONT, TEXAS
395	25	12	80	FORTUNE	T	LIB	99,009	0	74	FULL	5,442	5,442	5,485	1	KUWAIT CRUDE	F	26:10N	053:19E	103	W OF DUBAI, UTD. ARAB EMIRATES
396	28	12	80	JOHN A. MCCONE	T	USA	150,000	0	0	UNSP	272	272	272	1	HEAVY CRUDE	T	33:47N	118:15W	120	LONG BEACH, CALIFORNIA
397	29	12	80	JUAN A. LAVALLEJA	T	URU	131,663	0	0	UNSP	35,504	35,504	35,504	2	CONDENSATE	F	35:50N	000:20W	109	OFF ARZEW, ALGERIA
398	31	12	80	BLOSSOM	T	LIB	19,000	11,834	59	BALLAST	499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	144	50 MI. W. OF SARDINIA
399	4	1	81	HANNAH 4001 (BARGE)	B	USA	4,000	2,898	79	FULL	3,989	3,989	3,989	2	GASOLINE	T	UNSP	UNSP	82	AGROUND GALVESTON,TX
400	7	1	81	JOSE MARTI	T	RUS	41,000	27,706	78	FULL	997	618	997	2	HEAVY FUEL OIL	F	59:08N	018:25E	215	OFF DALARO, SWEDEN
401	8	1	81	CHOTIN 2880 (BARGE)	B	USA	0	0	0		324	324	324	2	GASOLINE:AVIATION	T	37:03N	088:36E	117	PADUCAH, KY OHIO RIVER MI. 972.3
402	19	1	81	CONCHO/BRADFORD ISLAND	T	USA	32,741	0	45		324	324	324	2	NO. 6 FUEL/NAPTHA	T	40:36N	074:01W	152	BROOKLYN, NY - NJ
403	28	1	81	OLYMPIC GLORY	T	GRE	77,874	0	64	FULL	2,721	2,721	3,239	1	CRUDE	T	29:41N	095:00W	82	GALVESTON BAY, TX
404	20	2	81	SEFIR	T	SWE	1,000	0	53		499	499	499	2	FUEL OIL	F	UNSP	UNSP	215	BALTIC SEA, SWEDEN
405	21	2	81	ERODENA (ERODONA)	T	BRI	31,000	19,656	78	FULL	486	486	499	2	FUEL OIL	F	17:51N	077:37W	44	PORT KAISER, JAMAICA
406	28	2	81	WORLD GALA	T	LIB	0	133,000	0		201	201	201	1	LIGHT ARABIAN CRUDE	F	23:48S	045:26W	376	SAO SEBASTIAO, BRAZIL
407	14	3	81	CHOTIN 1601 (BARGE)	B	USA	0	0	0		204	204	204	2	MINERAL SEAL	T	39:30N	092:26W	118	MILE 858, LOWER MISS. RIVER, MO
408	19	3	81	APEX HOUSTON (BARGE)	B	USA	0	0	0		3,407	204	3,407	2	NO. 6 FUEL	T	29:07N	089:20W	82	PILOTTOWN, LA LOW. MISS. R. MI. 13
409	28	3	81	TOKUYU MARU NO. 12	T	JAP	0	199	0		395	395	395	2	GASOLINE	F	34:40N	135:12E	131	OFF KOBE, JAPAN
410	29	3	81	CAVO CAMBANOS	T	GRE	20,000	12,780	56	FULL	20,269	17,951	20,269	2	NAPHTHA	F	41:11N	007:09E	180	TARRAGONA ROADS, OFF CORSICA
411	9	4	81	ENERGY ENDURANCE	T	LIB	205,807	0	67		1,798	1,798	2,992	2	BUNKER	F	32:45S	028:52E	441	OFF EAST LONDON, SOUTH AFRICA
412	13	4	81	CBC 137 (BARGE)	B	UNS	0	0	0		279	279	279	2	COAL TAR	T	UNSP	UNSP	153	OHIO RIVER MI. 184.3, OH
413	24	4	81	GEORGE S	T	GRE	117,000	59,958	68	FULL	490	490	490	1	CRUDE	F	21:56N	031:53W	76	500 MI N OF CAPE VERDE I,ATLANTIC O
414	11	5	81	QASQHA	T	SIN	4,000	0	0		2,493	2,493	2,493	2	GASOLINE	F	UNSP	UNSP	25	S. CHINA SEA?, BORNEO
415	20	5	81	ANNA XYLA	T	GRE	48,000	23,760	71	PARTIAL	499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	103	JEBEL DHANNA, PERSIAN G., ABU DHABI
416	11	6	81	SASCHA	T	SIN	2,000	1,503	61	FULL	1,995	1,995	1,995	2	BUNKER FUEL	F	03:43S	116:32E	324	MAKASSAR STRAIT, OFF BORNEO
417	10	7	81	METON	T	USA	33,881	0	0		149	149	149	2	BUNKER C NO.6	T	38:29N	073:50W	116	OFF VA
418	12	7	81	HAKUYOH MARU	T	JAP	102,000	59,060	74	EMPTY	2,992	2,992	2,992	2	FUEL OIL	F	44:30N	008:50E	180	LIGURIAN SEA, GENOA, ITALY
419	15	7	81	IRENES SINCERITY	T	GRE	27,000	12,923	59	BALLAST	499	499	499	2	BUNKER FUEL	F	23:30N	065:00E	102	ARABIAN SEA, 180 MI. SW OF KARACHI
420	25	7	81	AFRAN ZENITH	T	LIB	97,000	0	72	FULL	259	259	499	1	HEAVY CRUDE	F	53:33N	010:00E	216	HAMBURG, WEST GERMANY
421	30	7	81	MIN WOO 5	T	KOR	1,000	673	61	FULL	997	997	997	2	GASOLINE	F	UNSP	UNSP	131	EAST CHINA SEA?, BUSAN, S. KOREA
422	17	8	81	SCHELDERIX	T	LIB	231,000	0	78		571	490	571	1	ARABIAN CRUDE	F	29:53S	031:00E	404	DURBAN, S. AFRICA
423	5	9	81	APHRODITE B	T	GRE	36,000	0	65	FULL	1,166	1,166	1,197	1	LIGHT CRUDE	T	29:55N	090:05W	82	HARVEY, LA
424	30	10	81	GOLDEN ACE	T	KOR	6,000	4,020	65	FULL	5,485	5,485	5,485	2	SOLID RESIDUE & COKE	F	07:49N	116:00E	25	S. CHINA SEA NEAR BORNEO
425	5	11	81	GOGO RIDER	T	BRI	22,000	12,690	60	PARTIAL	499	499	499	2	NAPHTHA/FUEL OIL?	F	13:09N	054:13E	67	GULF OF ADEN/INDIAN O., SOCOTRA I.
426	21	11	81	GLOBE ASIMI	T	GIB	19,945	12,932	60	FULL	14,023	2,993	16,455	2	HEAVY FUEL OIL	F	55:43N	021:07E	214	BALTIC PORT,KLAIPEDA,LITHUANIA,USSR

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
427	30	11	81	STUYVESANT	T	USA	228,000	0	77		490	490	490	1	CRUDE	F	15:40N	095:00W	40	GULF OF TEHUANTEPEC, MEXICO
428	10	12	81	RIVA I	T	PAN	63,000	32,167	65	PARTIAL	499	499	499	2	BUNKER FUEL	F	29:30N	035:00E	0	GULF OF AQABA, ELIAT, ISRAEL
429	19	12	81	GULF ACE	T	PHI	1,000	872	66	FULL	698	698	698	2	FUEL OIL	F	15:00N	120:00E	61	ENTRANCE TO PORO, PHILLIPINES
430	22	1	82	IRIS	T	GRE	2,000	0	57		1,496	1,496	1,496	2	GASOLINE	F	UNSP	UNSP	142	MEDITERREAN SEA, GREECE
431	4	2	82	VARI	T	GRE	2,000	1,943	54	PARTIAL	499	499	499	2	FUEL OIL	F	35:00N	25:00E	142	SEA OF CRETE, IRAKLION, CRETE
432	16	2	82	MAKHANIK TARASOV	T	RUS	5,000	0	76		359	359	499	2	HEAVY FUEL/BUNKER	F	UNSP	UNSP	150	NORTH ATLANTIC O. OFF NEWFOUNDLAND
433	3	3	82	ONDINA	T	HOL	0	0	0		177	177	177	1	CRUDE	F	UNSP	UNSP	216	HARBOR AT HAMBURG, WEST GERMANY
434	6	3	82	GOLDEN DOLPHIN	T	USA	93,000	44,881	76	BALLAST	2,992	2,992	2,992	2	BUNKER FUEL	F	30:09N	046:23W	113	700 MI. EAST OF BERMUDA, ATLANTIC O
435	29	3	82	SIVONA	T	SWE	3,000	0	70	FULL	842	698	842	1	LIGHTCRUDE	F	UNSP	UNSP	215	OFF S.COAST OF SWEDEN NR HOOANAS
436	31	3	82	ARKAS	T	LIB	138,340	0	74		3,407	204	4,986	1	CRUDE	T	30:00N	090:28W	118	MI. 130 LOWER MISS. R. MONTZ, LA
437	3	4	82	FUKUTORU MARU 8	T	JAP	1,000	0	79		698	698	698	2	FUEL OIL	F	UNSP	UNSP	130	OFF JAPAN
438	10	4	82	BENENTANK (BARGE)	B	BEL	2,000	0	74		499	499	499	2	FUEL OIL	F	UNSP	UNSP	216	RIVER NEAR N. SEA OFF BELGIUM
439	13	4	82	FUKUYOSHOMI MARU	T	JAP	2,000	946	69	FULL	997	997	997	2	FUEL OIL	F	38:47N	139:24E	131	SEA OF JAPAN OFF HONSHU
440	5	5	82	(TANK SHIP)	T	UNS	0	0	0		162	162	162	2	NO. 6 FUEL	T	UNSP	UNSP	116	CAPE FEAR RIVER MI. 25.0, NC
441	9	6	82	KATINA	T	GRE	70,861	38,878	66	FULL	972	898	972	2	HEAVY FUEL OIL	F	UNSP	UNSP	216	OFF HOOK OF HOLLAND, NETH.
442	25	6	82	IMPERIAL ACADIA	T	CAN	10,475	0	0		272	272	272	2	DIESEL FUEL	F	UNSP	UNSP	151	OFF PORT AUX BASQUES, NEWFOUNDLAND
443	27	6	82	APEX 2904 (BARGE)	B	USA	2,000	0	0	FULL	1,088	1,088	1,296	2	NO. 6 FUEL	T	34:15N	092:00W	118	ARKANSAS R. MI. 6.5, PINE BLUFF, AR
444	29	6	82	BU 42 (BARGE)	B	USA	2,000	0	0		3,829	1,296	3,829	2	NO. 6 FUEL	T	UNSP	UNSP	118	ARKANSAS R MI 66 NR PINE BLUFF, ARK
445	10	7	82	ALOOL	T	BRI	57,000	0	77		997	997	997	2	BUNKER FUEL	F	UNSP	UNSP	8	CARRIBEAN SEA OFF PANAMA
446	15	7	82	MAROFA	T	POR	138,000	0	76		993	993	993	1	CRUDE	F	34:00S	018:00E	442	NEAR CAPETOWN W. AFRICA
447	23	7	82	B. 450-3 (BARGE)	B	UNS	0	0	0		680	680	680	2	GASOLINE: AUTOMOTIVE	T	30:08N	093:19W	118	NEAR PORT ARTHUR, LA
448	30	7	82	(TANK SHIP)	T	UNS	0	0	0		174	174	174	2	NO. 6 FUEL	T	UNSP	UNSP	82	LOWER MISSISSIPPI R. MI. 80.0, LA
449	1	8	82	(BARGE)	B	UNS	0	0	0		298	298	298	2	NO. 1-D FUEL	T	59:20N	162:43W	197	KUSKOKWIM BAY, AK
450	10	8	82	KINEI MARU	T	JAP	2,000	0	69		460	274	499	2	DIESEL FUEL	F	34:00N	135:00E	131	SETO NAKAI SEA, OFF KOBE, JAPAN
451	20	8	82	CORINTHIAN	T	LIB	89,194	44,262	67	BALLAST	1,260	1,260	1,260	2	HEAVY FUEL/BUNKER	F	25:18N	056:26E	103	OFF FUJAIRAH, UAE
452	14	10	82	UNIREA	T	RUM	163,647	88,285	79	BALLAST	648	648	2,993	2	FUEL OIL/BUNKER	F	42:40N	029:00E	177	38 MI. E. OF CAPE ERMINE, BUL.
453	8	11	82	SAMIR	T	MOR	90,654	51,543	77	PARTIAL	997	997	997	1	CRUDE OIL	F	33:44N	007:21W	109	PONT BLONDIN NR CASABLANCA, MORROCO
454	26	11	82	HARALABOS	T	LIB	99,308	45,267	66	PARTIAL	27,366	499	27,366	1	CRUDE	F	28:50N	032:45E	105	RAS GHARIB, GULF OF SUEZ
455	27	11	82	APT 150 (BARGE)	B	USA	0	0	0		136	136	136	1	NAPHTHACRUDE	T	30:15N	088:25W	117	PASCAGOULA, MISSISSIPPI
456	15	12	82	ORIENTAL NAVIGATOR	T	LIB	36,000	20,933	61	EMPTY	499	499	499	2	PETROLEUM COKE	F	UNSP	UNSP	60	PACIFIC O.?, PHILLIPINES
457	27	12	82	CHARALAMBOS	T	GRE	61,000	30,602	66	FULL	993	993	993	1	PERUVIAN CRUDE	F	22:00N	087:00W	81	GULF OF MEXICO, YUCATAN, MEXICO

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	LOCATION			CASUALTIES			REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
1	HARB	P	COLLISON W/ OBJECT FLOATING IN WATER	0			
2	OPEN	S	COLLISION W/ SHIP AT SEA	0			
3	RESTR	S	COLLISN STRUCTR HULL RUPT	0			WIS
4	HARB	I	WEATHER COLLISION W/ BAUNE EXPLOSION FIRE	16			LLP-249
5	HARB	P	AGROUND STRUCTR HULL RUPT	0			WIS
6	PIER	P	COLLISION W/ SHIP	0			
7	PIER	P	UNLOADING, FIRE	0			LLP-195
8	RESTR	S	NAVIGATING, AGROUND	0			
9	RESTR	S	COLLISN STRUCTR HULL RUPT	0			WIS
10	OPEN	S	EXPLOSION FIRE FOUNDER	8			LLP-324
11	RESTR	S	UNDER TOW AGROUND	0			
12	HARB	P	UNSPECIFIED	0			WIS
13	PIER	I	EXPLOSION FIRE DURING UNLOADING, FOUNDER	13			LLP-146
14	RESTR	S	COLLISN	0			WIS
15	RESTR	I	AGROUND STRUCTUR HULL RUPT	0			MAR-WIS
16	RESTR	S	AGROUND	0			
17	RESTR	S	COLLISN W/ SHIP	0			DNV WIS
18	RESTR	S	OTHER	0			WIS
19	RESTR	S	OTHER	0			WIS
20	RESTR	S	COLLISION W/ FRENCH M/V ALPILLES	0			LLP-14
21	HARB	I	COLLISN STRUCTR HULL RUPT	0			
22	RESTR	S	COLLISN STRUCTR HULL RUPT	C			WIS
23	HARB	P	CONTACT W/ BRIDGE FOUNDER	0		SLIGHT POLLUTION	DNV WIS
24	HARB	P	UNSPECIFIED	0			WIS
25	PIER	P	ANCHORED FIRE (SPON. COMBUST. OIL CAKES)	0			LLP-325
26	HARB	P	COLLISN CAPSIZE	0			WIS
27	RESTR	S	AGROUND	0			
28	RESTR	S	RADAR BREAKDOWN AGROUND	0			
29	HARB	P	AGROUND STRUCTR HULL RUPT	0			
30	HARB	P	COLLISN STRUCTR HULL RUPT	0			WIS
31	OPEN	S	HIGH SEAS, EXPLOSION FIRE FOUNDER	9			LLP-470
32	HARB	P	COLLISN	0			MAR
33	HARB	P	UNSPECIFIED	0			WIS
34	HARB	I	COLLISN STRUCTR HULL RUPT	0			
35	PIER	P	MACHINE	0			WIS
36	PIER	P	COLLISION W/ SHIP	0			MAR-WIS
37	HARB	P	PERS ERR AGROUND HULL RUPT WEATHER ABANDON	0	DEAD PENGUINS, SEABIRDS	HEAVY POLLUTION 1,000 SQ MI WATER & COASTLINE	WIS MAR LLP-310
38	UNSP	S	COLLISN	0			WIS
39	PIER	P	UNLOADING OVERFILLING ERROR	0			
40	HARB	I	COLLISION W/ SHIP	0			
41	PIER	P	UNLOADING OVERFILLING ERROR	0			
42	RESTR	S	EXPLOSION FIRE FOUNDER	6			LLP-145
43	OPEN	S	MACHINE FIRE AGROUND ABANDON EXPLOSN	0		SERIOUS POLLUTION	DNV WIS LLP-484
44	RESTR	S	CONTACT AGROUND	0			MAR-WIS
45	RESTR	S	AGROUND STRUCTR HULL RUPT	0			MAR-WIS
46	HARB	P	UNSPECIFIED	0			WIS
47	RESTR	S	UNDER TOW AGROUND	0		MEDIUM AMOUNT OF COASTAL POLLUTION	
48	RESTR	S	WEATHER COLLISION EXPL FIRE STRUCT ABANDON	0			LLP-465
49	RESTR	S	LEAK OR FLOODING	0			
50	RESTR	S	OTHER	0			WIS
51	RESTR	S	COLLISION W/ SHIP	0			
52	RESTR	S	PERSONL	0			MAR-WIS
53	HARB	I	AGROUND STRUCTR HULL RUPT	0			WIS
54	RESTR	S	COLLISION W/SHIP FIRE EXPLOSION SCUTTLED	5			LLP-519
55	RESTR	S	AGROUND	0			LLP-416
56	RESTR	S	COLLISN	0			WIS MAR
57	RESTR	S	NAVIGATING, EXPLOSION AND FIRE	0			LLP-99
58	RESTR	S	WEATHER ANCHORED AGROUND	0			LLP-234
59	HARB	P	PERSONL TANK OVERFLOW	0			WIS
60	RESTR	S	AGROUND	0			
61	RESTR	S	AGROUND LEAKAGE	0		MODERATE POLLUTION	DNV WIS
62	HARB	P	COLLISN W/ SHIP	0		SLIGHT POLLUTION	MAR-WIS
63	RESTR	S	FIRE	0			LLP-303
64	OPEN	S	NAVIGATING LEAK TOW WEATHER FOUNDER	0			LLP79
65	OPEN	S	WEATHER LEAKAGE STRUCTR	0			DNV WIS
66	OPEN	S	HIGH SEAS COLLISION STRUCTURAL DAMAGE	0			WIS
67	RESTR	S	AGROUND EXPLOSION FIRE	2			LLP-277
68	RESTR	S	AGROUND STRUCTR HULL RUPT	0		SLIGHT POLLUTION	DNV WIS
69	PIER	P	WEATHER AGROUND EXPLOSN FIRE BROKE-IN-2	6		20 MI. BEACHES AND FISHING BEDS, AIR POLLUTION	DNV WIS LLP-229
70	HARB	P	COLLISN STRUCTR TANK RUPT	0			
71	PIER	P	COLLISN EXPLOSN FIRE HULLRUPT LEAKAGE FOUNDER	26			DNV WIS LLP-113

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	LOCATION		CASUALTIES				REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
72	RESTR	S	AGROUND	0			WIS
73	HARB	I	STRUCTR HULL RUPT	0			
74	RESTR	S	LEAKING/FLOODING FIRE ABANDON FOUNDER	0			LLP-359
75	OPEN	S	NAVIGATING COLLISION W/ SHIP AT SEA	0			
76	PIER	P	WEATHER AGROUND	0			LLP-220
77	HARB	I	COLLISN STRUCTR HULL RUPT	0			
78	RESTR	S	AGROUND	0			
79	HARB	I	COLLISION WITH BRIDGE	1			
80	HARB	I	COLLISN STRUCTR HULL RUPT	0			
81	HARB	I	COLLISN STRUCTR HULL RUPT	1			CO 01683
82	OPEN	S	EXPLOSION STRUCTURAL BROKE-IN-2 TOWED	35			LLP-238
83	RESTR	S	FIRE FOUNDER	0			LLP-49
84	HARB	P	WEATHER FIRE AGROUND LEAKAGE	0		SLIGHT POLLUTION	WIS-MAR
85	RESTR	S	LEAKING	0		SLIGHT COASTAL POLLUTION	
86	RESTR	S	WEATHER STRUCTR HULL RUPT BROKE-IN-2 SCUTTLED	1			WIS LLP-444-445
87	RESTR	S	COLLISION WITH SHIP AT SEA	0			
88	RESTR	S	UNSPECIFIED	0			WIS
89	RESTR	S	COLLISN W/CACTUS QUEEN EXPLOSION FIRE	0			WIS LLP-482
90	HARB	P	COLLISN STRUCTR HULL RUPT	0			WIS
91	OPEN	S	NAVIGATING, HULL CRACKS, FIRE	0			LLP-152
92	OPEN	S	NAVIGATING, STRUCTURAL DAMAGE	0			
93	RESTR	S	NAVIGATING, AGROUND	0			
94	RESTR	S	NAVIGATING, AGROUND	0			
95	RESTR	S	WEATHER	0			WIS-MAR
96	HARB	P	MACHINE	0			WIS
97	RESTR	S	DDISCHG	0			MAR WIS
98	HARB	P	OTHER	0			WIS
99	OPEN	S	CONTACT FIRE STRUCTR HULL RUPT ABANDON	6		MODERATE	DNV WIS LLP-185
100	RESTR	S	AGROUND FIRE	0			LLP-44
101	PIER	P	COLLISION W/ DOCK	0			
102	OPEN	S	WEATHER	0			MAR
103	RESTR	S	UNSPECIFIED	0			WIS
104	RESTR	S	LEAKAGE STRUCTR	0			DNV WIS
105	HARB	P	AGROUND	0			WIS
106	HARB	I	AGROUND STRUCTR HULL RUPT	0			CO01928
107	RESTR	S	AGROUND	0			LLP-410
108	PIER	P	UNLOADED WEATHER EXPLOSION FIRE STRUC FOUNDE	0			LLP-259
109	RESTR	S	UNSPECIFIED	0			MAR-WIS
110	RESTR	S	COLLISN CONTACT	0			MAR-WIS
111	RESTR	S	UNDER TOW AGROUND STRUCTR HULL RUPT	0			
112	PIER	P	MACHINE	0			WIS
113	RESTR	S	AGROUND	0			
114	RESTR	S	COLLISN STRUCTR HULL RUPT	0			WIS
115	RESTR	S	AGROUND	0			
116	RESTR	S	AGROUND	0			
117	PIER	P	ANCHORED NEAR COAST WEATHER AGROUND	0			LLP-486
118	RESTR	S	WEATHER MACHINE AGROUND STRUCT FLOOD	4	SLIGHT POLLUTION		LLP-347
119	RESTR	S	OTHER STRUCTR HULL RUPT FOUNDER?	0			DNV WIS
120	RESTR	S	FIRE EXPLOSN ABANDON	0	HUNDREDS OF THOUSANDS OF FISH KILLED	200 MI SLICK OFF ECUADOR-COLUMBIA BORDER	WIS LLP-405
121	HARB	I	AGROUND STRUCTR TANK RUPT	0			
122	RESTR	S	WEATHER AGROUND	0		SLIGHT POLLUTION	MAR-WIS
123	OPEN	S	COLLISN W/STRAAT ALGOA FOUNDER	0		HEAVY POLLUTION	WIS LLP-326
124	RESTR	S	MACHINE AGROUND	0			LLP-418
125	PIER	P	FIRE	0			LLP-102
126	HARB	P	CONTACT STRUCTR HULL RUPT	0			WIS
127	RESTR	S	WEATHER	0			MAR
128	RESTR	S	EXPLOSN FIRE STRUCTR HULL RUPT	0			WIS
129	RESTR	S	NAVIGATING, AGROUND	0			
130	RESTR	S	NAVIGATING, AGROUND HULL RUPT	0			LLP-147
131	RESTR	I	COLLISN STRUCTR HULL RUPT	0			WIS
132	HARB	P	UNDER TOW STRUCTR HULL RUPT LEAK	0			WIS
133	RESTR	S	CAPSIZE LEAK FOUNDER	6			LLP-135
134	HARB	P	AGROUND FIRE EXPLOSN ABANDON	1	SHELLFISH BEDS	SEVERE POLLUTION	MAR-WIS LLP-494
135	PIER	P	LOADING	0			
136	HARB	I	UNDER TOW WEATHER AGROUND STRUCTR HULL RUPT	0		MODERATE POLLUTION	WIS
137	RESTR	S	LEAK FLOODING FOUNDER	0			LLP-309
138	RESTR	S	NAVIGATING, FIRE	0			LLP-13
139	HARB	P	STRUCTR	0			MAR WIS
140	RESTR	S	COLLISN	0			MAR
141	RESTR	S	STEERING AGROUND HULL RUPT TOWED FIRE FLOOD	0			LLP-88
142	RESTR	S	COLLISION W/ SHIP AT SEA	0			

	LOCATION		CASUALTIES				REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
143	RESTR	S	COLLISN	0			MAR WIS
144	OPEN	S	WEATHER LEAKAGE STRUCTR FOUNDER	36			DNV WIS LLP-115-116
145	RESTR	S	AGROUND	0			
146	RESTR	S	TYPHOON STRUCTURAL DAMAGE	0			LLP-401
147	RESTR	S	AGROUND	0			MAR
148	HARB	P	COLLISN TANK RUPTURE	0			
149	PIER	P	STRUCTURAL DAMAGE	0			
150	RESTR	S	AGROUND	0			
151	RESTR	S	AGROUND STRUCTR HULL RUPT	0			MAR WIS
152	RESTR	S	AGROUND	0			
153	RESTR	S	WEATHER AGROUND FOUNDER	28	FISHERIES & SHELLFISH BEDS AFFECTED	WASHED ASHORE ILE DE SEIN, LATER BRITTANY COAST	MAR WIS LLP-74
154	RESTR	S	UNDER TOW, AGROUND	0			
155	RESTR	S	COLLISN	0			MAR WIS
156	RESTR	S	COLLISN AGROUND STRUCTR HULL RUPT	0			WIS
157	PIER	P	CONTACT	0			MAR
158	RESTR	S	NAVIGATING, AGROUND	0			
159	HARB	P	WEATHER AGROUND WHILE AT ANCHOR	0			LLP-444
160	HARB	I	UNDER TOW AGROUND	0			
161	RESTR	S	LEAK OR FLOODING	0			
162	RESTR	S	PERSONL AGROUND	0			MAR WIS LLP-43-44
163	PIER	P	EXPLOSN FIRE HULL RUPT BROKE-IN-2 FOUNDER	9			MAR WIS LLP-411
164	RESTR	S	AGROUND	0			MAR WIS
165	PIER	P	FIRE	0			LLP-230
166	OPEN	S	LEAKAGE	0			WIS
167	HARB	I	AGROUND STRUCTR HULL RUPT	0	5,000 WATER FOWL CONTAMINATED	POLLUTED NEW JERSEY SHORE	MAR WIS 76FACTSONFIL
168	OPEN	S	HIGH SEAS STRUCTURAL DAMAGE	38			MAR WIS LLP-191-192
169	HARB	P	CONTACT COLLISN STRUCTR HULL RUPT	0			WIS
170	OPEN	S	STRUCTR BROKE-IN-2 FOUNDER	3			MAR WIS LLP-223
171	RESTR	S	WEATHER AGROUND	0			
172	HARB	P	MACHINE	0			WIS
173	PIER	P	UNLOADING, PIPELINE LEAK, EXPLOSION, FIRE	0			
174	RESTR	S	AGROUND STRUCTR HULL RUPT	0			
175	RESTR	S	EXPLOSION FIRE AGROUND	9			LLP-160
176	HARB	P	AGROUND STRUCTR HULL RUPT	0			WIS
177	HARB	I	UNDER TOW AGROUND STRUCTR TANK RUPT	0		SLIGHT POLLUTION	WIS
178	RESTR	S	AGROUND	0			WIS
179	RESTR	S	AGROUND LEAKAGE WEATHER FOUNDER	0		44 MI. COASTLINE	MAR WIS LLP-75-76
180	OPEN	S	WEATHER HULL RUPTLEAKAGE EXPLOSN FIRE FOUNDE	1			MAR WIS 77 LLP-201
181	HARB	P	AGROUND	0			MAR
182	HARB	P	AGROUND	0			WIS
183	OPEN	S	EXPLOSION BROKE-IN-2 HALF-SCUTTLED HALF-TOWE	12			LLP-108
184	HARB	P	COLLISON W/ SHIP IN A CHANNEL	0			
185	OPEN	S	HIGH SEAS EXPLOSION	0			
186	HARB	I	AGROUND STRUCTR HULL RUPT	0			
187	RESTR	S	NAVIGATING, COLLISION WITH SHIP, FIRE	0			
188	RESTR	S	EXPLOSION FIRE	9			LLP-493
189	HARB	I	NAVIGATING, AGROUND	0			
190	HARB	P	DDISCHG	0			WIS-MAR
191	OPEN	S	WEATHER MACHINE LEAKAGE FOUNDER	0			MAR WIS LLP-90
192	RESTR	S	AGROUND	0			WIS
193	PIER	P	ANCHORED CAUGHT FIRE	0			
194	HARB	I	COLLISN STRUCTR TANK RUPT	0			
195	RESTR	S	COLLISN	0			WIS
196	HARB	I	COLLISION W/ DOCK IN A LOCK	0		SLIGHT COASTAL POLLUTION	
197	PIER	P	CONTACT W/SUNKEN BARGE FIRE	0			LLP-121
198	RESTR	S	WEATHER, TOWLINES BROKE, AGROUND	0		ROMELIA 20,421 DWT BUILT 1959	LLP-38,395, IFP7731
199	RESTR	S	COLLISION W/ SHIP	0			
200	HARB	P	CONTACT	0			WIS
201	RESTR	S	COLLISN STRUCTR TANK RUPT	0			WIS
202	HARB	P	NAVIGATING, EXPLOSION	18			
203	OPEN	S	COLLISN	0			MAR WIS
204	RESTR	S	DDISCHG	0			WIS
205	RESTR	S	OTHER	0			WIS
206	HARB	P	CONTACT	0			MAR WIS
207	RESTR	S	WEATHER AGROUND LEAKAGE	0		SLIGHT POLLUTION	DNV WIS
208	RESTR	S	WEATHER LEAKAGE STRUCTR	0			MAR WIS
209	RESTR	S	MACHINE	0			MAR WIS
210	HARB	P	COLLISN STRUCT HULL RUPT	0			WIS
211	RESTR	S	EXPLOSN FIRE ABANDON	1			MAR LLP-303
212	HARB	P	OTHER	0			WIS
213	RESTR	S	COLLISN STRUCTR TANK RUPT	0			WIS

	LOCATION			CASUALTIES			REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
214	RESTR	S	BROKEN TOW LINE, AGROUND	0			
215	RESTR	S	WEATHER MACHINE COLLISN W/VENPET FIRE AGROUND	2			DNV WIS MAR LLP-498
216	RESTR	S	COLLISN W/ VENOIL FIRE	1			WIS MAR LLP-498,499
217	RESTR	S	WEATHER STRUCTR	0			WIS
218	RESTR	S	AGROUND	0			MAR
219	RESTR	S	UNSPECIFIED	0			
220	RESTR	S	PERSONL AGROUND LEAK STRUCTR HULL RUPT	0			WIS
221	RESTR	S	AGROUND LEAKAGE	0			MAR-WIS
222	RESTR	S	COLLISION W/HOLSTENSAND FOUNDER	0			LLP-102
223	RESTR	S	EXPLOSION FIRE ABANDON AGROUND	2			LLP-364
224	RESTR	S	NAVIGATING, UNKNOWN	0			
225	HARB	P	COLLISN STRUCTR TANK RUPT	0			WIS
226	RESTR	S	NAVIGATING	0			
227	PIER	P	COLLISN W/ SHIP STRUCTR TANK RUPT	0			
228	RESTR	S	UNDER TOW, COLLISION	0			
229	HARB	P	COLLISN STRUCTR HULL RUPT	0			WIS
230	HARB	P	ANCHORED WEATHER LEAK AGROUND	0			LLP-184
231	HARB	P	CONTACT AGROUND STRUCTR TANK RUPT	0			MAR-WIS
232	HARB	P	AGROUND	0			
233	RESTR	S	EXPLOSION FIRE FOUNDER	5			LLP-93
234	PIER	P	UNLOADING FIRE	5			WIS LLP-409
235	RESTR	S	MACHINE OTHER AGROUND	0	DEAD FISH & BIRDS, 8,120 TONS OYSTERS DESTROYED	HUNDREDS OF KILOMETERS OF BEACH	DNV MAR WIS IR-XI144
236	RESTR	S	UNDER TOW AGROUND STRUCTR HULL RUPT	0			WIS
237	PIER	P	EXPLOSN FIRE BROKE-IN-2 AGROUND	2			WIS LLP-219
238	RESTR	S	MACHINE AGROUND	0			MAR-WIS LLP-5
239	HARB	P	CONTACT STRUCTR TANK RUPT	0			WIS
240	RESTR	S	CONTACT AGROUND	0			MAR-WIS
241	RESTR	S	STEERING PROBLEMS AGROUND	0			LLP-51
242	RESTR	S	AGROUND	0			
243	HARB	I	UNDER TOW COLLISN W/ SHIP STRUCTR HULL RUPT	0			
244	HARB	I	AGROUND STRUCTR HULL RUPT	0			
245	RESTR	S	WEATHER COLLISN W/ ROSELINE CUT-IN-2 FOUNDER	0		20 MILES COAST AFFECTED-NORFOLK & SUFFOLK BEACHES	MAR-WIS LLP-146
246	RESTR	S	AGROUND	0			
247	HARB	P	AGROUND	0			LLP-25
248	OPEN	S	NAVIGATING, STRUCTURAL DAMAGE	0			
249	PIER	P	CONTACT MACHINE	0			WIS
250	UNSP	S	UNSPECIFIED	0			WIS
251	HARB	P	UNSPECIFIED	0			WIS
252	OPEN	S	AGROUND, SCUTTLED 100 MI. OFFSHORE	0		EXTENSIVE POLLUTION	MAR-WIS LLP-83
253	RESTR	S	COLLISN	0			MAR
254	HARB	I	COLLISN STRUCTR HULL RUPT	0			
255	RESTR	S	WEATHER FIRE	0			LLP-257
256	OPEN	S	FIRE FLOODING	0			LLP-214
257	OPEN	S	COLLISN LEAKAGE	0			MAR-WIS
258	PIER	P	PERSONL	0			
259	RESTR	S	COLLISION W/HINODE MARU NO. 58	0			LLP-401
260	RESTR	S	NAVIGATING	0			
261	PIER	P	UNLOADING MACHINE HOSE RUPTURE	0			MAR-WIS
262	RESTR	S	AGROUND LEAKAGE SCUTTLED	0		MINOR POLLUTION	MAR-WIS LLP-103
263	RESTR	S	AGROUND	0			
264	PIER	P	UNLOADING	0			
265	RESTR	S	AGROUND	0			
266	HARB	P	AT ANCHOR, WEATHER, EXPLOSION, FIRE, FOUNDER	30			LLP-163
267	RESTR	S	UNLOADING EXPLOSION LEAK/FLOODING	0			LLP-289
268	HARB	P	AGROUND STRUCTR HULL RUPT	0			WIS
269	RESTR	S	NAVIGATING NO CAUSE CITED	0			
270	HARB	P	COLLISN STRUCTR HULL RUPT	0			WIS
271	RESTR	S	WEATHER AGROUND LEAKAGE TANK RUPT	0		HEAVY POLLUTION 40 MI BEACHES, PUERTO RICO	DNV WIS LLP-364
272	PIER	P	FIRE EXPLOSION	0			LLP-255
273	HARB	P	WEATHER FIRE CONTACT	0			MAR-WIS
274	RESTR	S	WEATHER HULL RUPT LEAKAGE EXPLOSN FIRE	30		SLIGHT POLLUTION	DNV WIS LLP-30
275	OPEN	S	WEATHER EXPLOSION FIRE FOUNDER	32			LLP-302
276	PIER	P	UNDLOADING FIRE EXPLOSN SPLIT-IN-2 FOUNDER	51		SLIGHT POLLUTION	WIS-MAR LLP-69
277	HARB	I	COLLISN STRUCTR HULL RUPT	0			WIS-MAR
278	RESTR	S	AGROUND	0	30,000 BIRDS KILLED	SLIGHT POLLUTION	WIS
279	PIER	P	PERSONL	0			
280	HARB	I	AGROUND ON ANCHOR, STRUCTR, TANK RUPT	0		SLIGHT POLLUTION	MAR-WIS
281	RESTR	S	AGROUND STRUCTR HULL RUPT	0			
282	RESTR	S	CONTACT COLLISN STRUCTR TANK RUPT	0			
283	RESTR	S	COLLISN	0			WIS
284	HARB	P	COLLISN STRUCTR HULL RUPT	0			MAR-WIS

	LOCATION			CASUALTIES			REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
285	RESTR	S	AGROUND	0		MODERATE POLLUTION	MAR-WIS
286	RESTR	S	AGROUND	0			MAR-WIS
287	RESTR	S	CONTACT WEATHER	0			MAR
288	PIER	P	OTHER	0			MAR
289	HARB	P	AGROUND	0			MAR
290	RESTR	S	CONTACT AGROUND	0		SLIGHT POLLUTION	WIS
291	RESTR	S	AGROUND	0		SLIGHT POLLUTION	MAR-WIS
292	RESTR	S	AGROUND LEAKAGE	0			WIS
293	RESTR	S	DDISCHG	0		ICE ENCIRCLEMENT	WIS MAR
294	OPEN	S	WEATHER STRUCTR	0			MAR-WIS
295	RESTR	S	CONTACT ICE RAMMING SCUTTLED	0			WIS ENVCAN-7/87
296	HARB	P	AGROUND COLLISN STRUCTR HULL RUPT	0			WIS
297	RESTR	S	AGROUND	0			WIS ENVCAN-7/87
298	RESTR	S	COLLISN	0		SLIGHT POLLUTION	
299	RESTR	S	AGROUND	0			
300	OPEN	S	COLLISN	0			MAR-WIS
301	HARB	P	CONTACT COLLISN STRUCTR HULL RUPT	0			WIS
302	HARB	I	CONTACT	0			
303	PIER	P	ERROR AT TERMINAL	0			
304	RESTR	S	COLLISN STRUCTR TANK RUPT	0			
305	PIER	P	WEATHER, COLLISION W/ TEAM CASTOR, FOUNDER	2			LLP-183
306	HARB	P	COLLISN	0			MAR
307	RESTR	S	LEAK OR FLOODING	0			
308	HARB	I	CONTACT COLLISN STRUCTR HULL RUPT	0			
309	RESTR	S	CONTACT	0			WIS
310	HARB	I	COLLISN	0			
311	PIER	P	TANK-CLEANING EXPLOSION FIRE	5			LLP-55
312	HARB	I	COLLISION W/ MT EXPLOSION FIRE AGROUND	0			LLP-295
313	RESTR	S	COLLISION W/ SHIP	0			
314	HARB	I	AGROUND	0			
315	HARB	P	AGROUND FIRE	0			LLP-522
316	HARB	P	COLLISN STRUCTR HULL RUPT	0			
317	RESTR	S	WEATHER COLLISN W/SHIP FIRE ABANDON FOUNDER	29			WIS-MAR LLP-499
318	HARB	P	CONTACT	0		SLIGHT POLLUTION	WIS-MAR
319	OPEN	S	WEATHER EXPLOSN FIRE CAPSIZE FOUNDER	12			MAR-WIS LLP-57
320	RESTR	S	WEATHER COLLISN LEAKAGE FIRE AGROUND	0			MAR-WIS LLP-5,54
321	RESTR	S	WEATHER COLLISN LEAKAGE FIRE	29			MAR-WIS LLP-54
322	RESTR	S	COLLISN	0			WIS
323	PIER	P	UNLOADING EXPLOSION FIRE	2			
324	OPEN	S	FOUNDER	0			LLP-54
325	RESTR	S	AGROUND ON REEF	0			
326	PIER	P	EXPLOSN FIRE TOWED ABANDON FOUNDER	7			MAR-WIS LLP-220
327	HARB	P	CONTACT	0			MAR-WIS
328	PIER	P	ANCHORED FOR REPAIRS FIRE EXPLOSION	0			LLP-362
329	RESTR	S	EXPLOSION FOUNDER	5			LLP-99
330	PIER	P	UNLOAD WEATHER EXPLOSN FIRE FOUNDER HULL RUP	3		SERIOUS POLLUTION	MAR-WIS LLP-100
331	RESTR	S	NAVIGATING, AGROUND ON REEF	0			
332	RESTR	S	EXPLOSION	1			
333	HARB	I	COLLISN STRUCTR TANK RUPT	0			
334	RESTR	S	AGROUND	0		SLIGHT POLLUTION	MAR WIS
335	HARB	P	CONTACT EXPLOSN FIRE	0			MAR
336	RESTR	S	WEATHER AGROUND	0			
337	RESTR	S	AGROUND LEAKAGE	0		SLIGHT POLLUTION	WIS-MAR
338	HARB	I	STRUCTR	0			
339	HARB	I	AGROUND SUBMERGED OBJECT, EXPLOSION, FIRE	0		MODERATE POLLUTION	LLP-194
340	RESTR	S	COLLISN W/ MIMOSA FIRE EXPLOSN AGROUND	32		MODERATE POLLUTION, FIRE CONTINUED THRU 11/28/79	MAR-WIS LLP-81
341	OPEN	S	WEATHER LEAK/FLOODING	20			
342	RESTR	S	FIRE EXPLOSION	0			
343	RESTR	S	PERSONNEL ERROR COLLISN EXPLOSN FIRE AGROUND	42	IMMENSE ECOLOGICAL DAMAGE	SEVERE POLLUTION	MAR-WIS LLP-217
344	PIER	P	ANCHORED FOG COLLISION W/ DOCKED SHIP	0			
345	HARB	I	CONTACT W/ QUAYSIDE STRUCT FOUNDER	0			LLP-96
346	RESTR	S	STRUCTR AGROUND	0			WIS
347	RESTR	S	EXPLOSION,FIRE,TOWED,BROKE-IN-2,1/2-FOUNDERED	1			LLP-150-151
348	OPEN	S	WEATHER HULL RUPT	0			WIS LLP-488
349	PIER	P	PERSONL MACHINE	0			WIS
350	HARB	P	COLLISN EXPLOSN FIRE	4			DNV WIS
351	RESTR	S	BROKE-IN-2 FOUNDER	0			LLP-102
352	OPEN	S	FRAUD/MUTINY? FIRE EXPLOSION ABANDON FOUNDER	0			
353	RESTR	S	AGROUND STRUCTR TANK RUPTURE	0			CG02012
354	RESTR	S	PERSONL AGROUND	0		SLIGHT POLLUTION	WIS
355	RESTR	S	AGROUND	0			

Spill Inventory for January 1, 1974 to December 31, 1982

	LOCATION		CASUALTIES				REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
356	HARB	P	COLLISN	0			WIS
357	PIER	P	EXPLOSN FIRE FOUNDER	2		SLICK SET SFAKTIRIA I COASTLINE ON FIRE	WIS LLP-223
358	RESTR	S	COLLISN STRUCTR TANK RUPTURE	0			WIS
359	RESTR	S	AGROUND	0			
360	RESTR	S	COLLISN	0			MAR
361	RESTR	S	COLLISN	0		SLIGHT POLLUTION	WIS
362	RESTR	S	WEATHER RUPTURE EXPLOS STRUCTR FOUNDER	8		CHANNEL ISL., 200KM BRITTANY COAST	DNV WIS LLP-463
363	RESTR	S	EXPLOSION FOUNDER	36			LLP-292
364	PIER	P	ERROR AT TERMINAL	0			
365	HARB	I	COLLISION	0			
366	HARB	P	COLLISN STRUCTR HULL RUPT	0			
367	RESTR	S	MACHINE STEERING PROB. AGROUND	0			
368	OPEN	S	EXPLOSION FIRE FOUNDER	6			LLP-15
369	OPEN	S	EXPLOSION BROKE-IN-2 FOUNDER	1			LLP-323
370	HARB	I	COLLISN STRUCTR HULL RUPTURE	0			
371	HARB	P	EXPLOSION FIRE	0			
372	RESTR	S	EMERG DDISCHG	0			WIS
373	HARB	P	COLLISN STRUCTR HULL RUPT	0			
374	RESTR	S	WEATHER COLLISN	0			WIS
375	RESTR	S	AGROUND	0			
376	RESTR	S	COLLISN	0			WIS
377	RESTR	S	AGROUND STRUCK BANK	0			WIS
378	OPEN	S	EXPLOSION STRUCTURAL DAMAGE	0			
379	RESTR	S	COLLISN CONTACT	0			WIS-MAR
380	RESTR	S	PERSONL VALVE LEFT OPEN	0			WIS
381	OPEN	S	CONTACT W/UNMANNED OIL WELLHEAD EXPLOSION FIR	0			WIS LLP-468
382	RESTR	S	FOG COLLISN	0			WIS
383	OPEN	S	CAPSIZE FOUNDER	43			WIS
384	HARB	P	STRUCTR HULL RUPTURE	0			WIS
385	OPEN	S	WEATHER CAPSIZE FOUNDER	0			WIS
386	PIER	P	PERSONL LOADING TANK OVERFLOW	0			WIS
387	RESTR	S	COLLISN	0			WIS
388	RESTR	S	COLLISN	0			WIS
389	RESTR	S	AGROUND HULL RUPTURE	0		POLLUTION	LLP-372
390	OPEN	S	COLLISN	0			WIS
391	RESTR	S	AGROUND STRUCTR HULL RUPTURE	0			WIS
392	HARB	P	STRUCTR HOLED BY ANCHOR	0		SLIGHT POLLUTION	MAR-WIS
393	RESTR	S	COLLISION W/ SHIP	0			
394	PIER	P	PERSONL LOADING OVERFLOW	0		SLIGHT POLLUTION	WIS
395	RESTR	S	AGROUND	0			WIS
396	RESTR	S	TANK RUPTURE	0			MAR-WIS
397	RESTR	S	WEATHER CONTACT AGROUND	0			WIS
398	OPEN	S	EXPLOSION,BROKE-IN-2,1/2 FOUNDER,TOW AGROUND	1			LLP-72
399	RESTR	S	AGROUND LEAK FOUNDER TOWED SCUTTLED	0			LLP-199
400	RESTR	S	AGROUND	0		POLLUTED THE STOCKHOLM ARCHIPELAGO	OSIR 10,13,33
401	HARB	I	COLLISN STRUCTR HULL RUPT	0			
402	HARB	P	AGROUND STRUCTR HULL RUPT	0			
403	HARB	P	COLLISN STRUCTR TANK RUPT	0		SLIGHT POLLUTION	
404	RESTR	S	WEATHER ICE LEAK/FLOODING	0			
405	HARB	P	ANCHORED WEATHER AGROUND	0		SLIGHT POLLUTION	
406	PIER	P	OFFLOADING	0			
407	HARB	I	COLLISN	0			
408	HARB	P	COLLISN STRUCTR HULL RUPT	0			
409	RESTR	S	COLLISN	4			
410	PIER	P	ENGINE ROOM EXPLOSION FIRE SCUTTLED	5			LLP94-95
411	OPEN	S	WAVE	0			
412	HARB	I	COLLISN STRUCTR HULL RUPT	0			
413	OPEN	S	FIRE ABANDON	0			LLP-179
414	RESTR	S	FIRE	0			
415	PIER	P	LOADING EXPLOSION FIRE FLOODING AGROUND	0			LLP-35
416	RESTR	S	FIRE FOUNDER	4			LLP-415
417	OPEN	S	PERSONNL TANK WASHING	0			
418	PIER	P	WEATHER-LIGHTENING EXPLOSION FIRE	6			LLP-148
419	OPEN	S	FIRE	0			LLP-224
420	HARB	P	CONTACT W/BRIDGE AGROUND	0		MODERATE POLLUTION	
421	RESTR	S	FIRE	1			LLP-313
422	RESTR	S	NAVIGATING RAMMING CRACK IN HULL PLATING	0			
423	HARB	P	COLLISN	0		SLIGHT POLLUTION	
424	RESTR	S	LEAK FOUNDER	0			LLP-187
425	OPEN	S	FIRE	0			LLP-186
426	HARB	P	WEATHER AGROUND BROKE IN HALF	0		HEAVILY IMPACTED 25 MI COASTLINE AROUND KLAIPEDA	LLP-185

	LOCATION		CASUALTIES				REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
427	RESTR	S	SEVERE WEATHER, CRACKED CARGO TANK	0			
428	PIER	P	UNLOADING FIRE	2			LLP-394
429	HARB	P	AGROUND AT FULL SPEED	0		SLIGHT POLLUTION	LLP-193
430	RESTR	S	AGROUND	0			
431	RESTR	S	WEATHER AGROUND LEAK	0			LLP-496
432	OPEN	S	WEATHER LEAK LISTING	33			
433	PIER	P	VALVE	0			
434	OPEN	S	EXPLOSION FIRE	9			LLP-187
435	RESTR	S	COLLISN	0			
436	HARB	I	COLLISN STRUCTR TANK RUPT	0			
437	RESTR	S	COLLISION W/ SHIP	0		SLIGHT POLLUTION	
438	HARB	P	COLLISION W/ SHIP	0		SLIGHT POLLUTION	
439	RESTR	S	WEATHER LEAK FOUNDER	0			LLP-172
440	HARB	P	STRUCTR HULL RUPT	0			
441	RESTR	S	ANCHOR	0		SLIGHT POLLUTION	
442	RESTR	S	AGROUND	0			
443	HARB	I	CONTACT W/ BRIDGE AGROUND	0		SLIGHT POLLUTION	
444	HARB	I	CONTACT STRUCTR TANK & HULL RUPT	0			CO01197
445	RESTR	S	FIRE	10			
446	RESTR	S	NAVIGATING STRUCTURAL DAMAGE	0			
447	HARB	P	AGROUND HULL RUPT	0			
448	HARB	P	STRUCTR HULL RUPT	0			
449	RESTR	S	STRUCTR HULL RUPT FOUNDER?	0			
450	RESTR	S	COLLISN W/ SHIP	0			
451	RESTR	S	EXPLOSION FIRE SCUTTLED	0			LLP-113
452	RESTR	S	EXPLOSION FIRE BROKE-IN-2	2			LLP-492
453	PIER	P	WEATHER AGROUND	0			LLP-408
454	PIER	P	LOADING EXPLOSION FIRE AGROUND	0			LLP-199
455	RESTR	S	WEATHER COLLISN STRUCTR HULL RUPT	0			
456	PIER	P	FIRE	25			LLP-352? 12/16/81
457	RESTR	S	NAVIGATING, STRUCTURAL HULL DAMAGE	0			LLP-97

	REFERENCE SOURCE					
	OSIR	OSB	CGUARD	IFP	GOLOB	COMMENTS
1				7401		
2				7402		
3			10592			
4				7403		
5			1662			FO HAD AS BASRAH CRUDE CG SHOWS ONLY AS NO. 6 FUEL
6				7404		
7				7405		
8				7406		
9			1782	7408		
10				7409		
11				7410		
12				7413		
13				7414		IFP HADCRUDE, LLP HADCARGO VENEZUELAN HEAVY ASPHALT OIL
14				7415		
15			11004			NEAR BROCKVILLE,CANADA
16				7418		
17				7420		
18						MAY BE A DUPLICATE TO ISOMERIA-SAME DATE & LOC.-CAN'T VERIFY
19				7421		IFP SAYS AT PIER, FO LAT/LON IN RESTR WATERS
20				7423		
21			707			
22			10323			
23				7426		ORIGINALLYCODED TANKER
24						
25				7427		
26			9675			FO HAD 7/8/74
27				7430		
28				7431		
29			2508			
30			7624			
31				7433		
32						
33				7434		
34			929			
35						
36				7435		
37				7436		
38						
39				7439		
40				7441		
41				7442		
42				7443		
43				7444		
44				7445		
45			2876			FO HAD VENEZUELANCRUDE CG HAS AS ONLY NO. 6 FUEL
46			8466			
47				7446		
48				7447		COLLISION W/OBO QUEEN. TOWED, BROKE-IN-2 FOUNDER & SCUTTLED
49				7448		
50						
51				7449		
52				7451		
53			9826	7450		
54				7454		COLLISION W/PACIFIC ARES
55				7455		
56				7458		
57				7459		
58				7462		
59			10242			FO HAD 12/22/74, UNDPEC. PRDT., MI. 150
60				7501		
61				7503		
62				7505		
63				7506		
64				7507		
65				7515		FO HAD NO. 2 FUEL
66				7502		
67				7508		
68			580	7510		
69				7513		
70			1680	7512		
71	8.44		894	7514		EDGAR M. QUEENY MANOEUVRING FROM DOCK STRUCK BERTHED CORIN.

	REFERENCE SOURCE					
	OBIR	OSB	CGUARD	IFP	GOLOB	COMMENTS
72						
73			1350			
74				7516		
75				7517		
76				7518		
77			1981			
78				7519		
79			1682	7520		
80			1519			
81			1682	7520		
82				7522		
83				7523		
84				7524		
85				7526		
86			781	7527		IFP &CG FUEL. LLPCARGO WAS CRUDE OIL. CG HAD POLAR PARAGUAY
87				7529		
88				7530		
89				7531		1 MI. S OF THE ST. JOHN IS., CACTUS QUEEN'S CRUDE CARGO OK
90			39	7525		
91				7532		
92				7533		
93				7535		
94				7538		
95				7539		
96			590			FG HAD LORENZO HALCOUSSI
97						
98				7540		
99			671	7542		STRUCK PLATFORM A IN GULF OF MEXICO
100				7541		
101				7543		
102						
103						
104				7548		
105			2373			
106			1892			
107				7550		
108				7549		AFTER UNLOADED 95K TONS CRUDE AT SINGLE BUOY MOORING-JURONG
109						
110				7553		
111			1587	7555		
112			712			
113				7557		
114			2242			
115				7601		
116				7603		
117				7604		
118				7606		
119			1669	7608		FG HAD 2/1/76, CRUDE OIL CG HAD ONLY AS NO. 6 FUEL
120				7609		
121			2307			
122				7611		
123				7612		
124				7613		
125			1522			
126				7614		
127						
128			2024			
129				7617		
130				7620		
131			1304			
132			2606	7623		
133				7622		
134				7624		
135				7625		
136			2424	7629		
137				7630		
138				7633		
139			829			
140						
141				7635		
142				7637		

	REFERENCE SOURCE					
	OSIR	OSB	COUARD	IFP	GOLOB	COMMENTS
143				7638		
144				7639		
145				7643		
146				7644		
147				7645		
148			2628			
149				7646		
150				7647		
151			2534	7648		
152				7649		
153				7650		3 DIVERS KILLED IN CLEANUP, SAME AREA IMPACTED AS AMOCOCADIZ
154				7652		
155				7653		
156			1427	7655		
157						
158				7657		
159				7659		SPILLED FUEL, CARGO 30,700 LONG TONS LIBYAN CRUDE OK
160				7660		
161				7661		
162			957	7662		
163			825	7663		HAD ALREADY UNLOADED CARGO OF INDONESIAN LIGHT CRUDE
164				7664		
165				7665		
166				7666		FUTURES GROUP HAD LIGHT CRUDE.
167			860	7668		
168				7669		LOST AT SEA, LAST SITED 30 MI. SE CAPE SABLE 12/30/76
169			2549			
170				7702		
171				7703		
172						
173				7704		
174			2394	7705		
175				7706		
176			2702			
177			1844	7707		
178				7708		
179				7709		
180				7712		77FACTS-ON-FILE
181						
182				7715		
183				7716		
184				7717		
185				7719		
186			4013			
187				7720		
188				7721		
189				7722		
190						
191				7723		
192						
193				7725		
194			2219			
195			2192			
196				7726		
197				7728		
198				7730		BOTH VESSELS UNDER TOW, AGROUND 10-15 MI. OFF CAPE TOWN, AFR
199				7732		
200						
201			1521			
202				7733		
203				7734		IFP HAS CRUDE OIL. FUTURES GROUP HAD REFINED PRODUCT
204						
205						
206						
207				7740		
208				7739		IFP HADCRUDE OIL. FO HAD HEAVY OIL
209				7741		
210			2598			
211				7742		FO HAD REFINEDCRUDE, LLP-DIRTY OIL, IFP-LUBE OIL
212						
213			2538			

	REFERENCE SOURCE					
	OSIR	OSB	COGUARD	IPP	GOLOB	COMMENTS
214				7743		
215						
216						VENOIL RENAMED RESOLUTE IN 1981
217						VENPET RENAMED ALEXANDER THE GREAT IN 1980
218				7746		
219				7801		
220	78SUM		2462	7803		
221	78SUM			7804		
222				7805		
223				7806		
224				7807		
225	78SUM		1728			
226				7808		
227	78SUM 78FACTSONFILE		3028	7809		
228				78X		
229			2090			
230				7813		
231	78SUM		808			
232			781			
233				7812		
234	78SUM					LLP-DISCHARGING CARGO OF CRUDE. OSIR 78SUM TYPE OIL UNKNOWN
235	78SUM 8,9 9,13,17,18			7814	II.11	LARGEST TANKER SPILL IN HISTORY LLP-25-27
236	78SUM		2801	7815		
237	78SUM		1540	7816		
238	78SUM			7817		
239	78SUM		2673			
240	78SUM			7818		
241				7819		
242				7821		
243	78SUM		2633	7822		
244	78SUM		2224			
245	78SUM 78FACTSONFILE			7823		
246				7824		
247				7825		
248				7826		
249	78SUM					
250						
251						EARTHQUAKE IN JAPAN THAT DAY
252	78SUM			7828		
253						
254			2751			
255				7830		
256				7831		
257	78SUM			7832		COLLIDED WITH BRAZILIAN BULKCARRIER WHICH SPILLED 2,905 BBL
258	78SUM					
259				78X?		
260				7833		
261	78SUM					
262	78SUM			7834		
263	78SUM					
264				7836		
265				7837		
266				7838		HAD JUST DISCHARGED CARGO OF CHINESE CRUDE AT BATAAN REFIN.
267				7839		
268	78SUM		6313			
269				7840		
270	78SUM		2616			
271	78SUM		7806	7842		ONE REFERENCE HAD CRUDE OIL
272				7844		
273	78SUM			7845		
274	78SUM			7846		
275	79SUM			7902		
276	79SUM			7903		
277	79SUM		600			
278	79SUM			7904		
279	79SUM			7905		
280	79SUM		927	7906		HOLING BY OWN ANCHOR
281			2503			
282	79SUM		299			
283	79SUM					
284	79SUM		1861			USCG #02047 - 1,600 BBL GULFOIL SPILL IN SAME PLACE 2/26/78

	REFERENCE SOURCE					
	OSIR	OSB	CGUARD	IFP	GOLOB	COMMENTS
285	79SUM			7912		
286	79SUM			7911		
287						
288						
289						
290	79SUM			7913		
291	79SUM			7914		
292	79SUM			7915		
293	79SUM					
294				7916		
295	79SUM			7917		SCUTTLED S. OF SABLE ISLAND 4/1/79
296	79SUM		3057	7918		COLLIDED WITH TANKER
297						ENVCAN SHOWS AS CANSO LIGHT ON 2/2/79
298	79SUM			7919		
299				7920		
300	79SUM			7921		
301			2372			
302	79SUM					
303				7923		
304	79SUM		1118			
305				7924		
306						
307				7926		
308	79SUM		1988			
309						
310			2136			
311				79-28		CLEANING OUT TANKS FROM PREVIOUS CARGO OF NAPHTHA
312				79-31		COLLISON WITH MOTOR TANKER BRUCE BINTAN
313				7932		
314				7934		
315				7935		60 MI. N OF DUBAI
316			2283			
317	79SUM			7937		COLLISION W/EMMANUEL DELMAS
318	79SUM			7936		
319	79SUM			7938		
320	79SUM			7941		COLLISION WITH ATLANTIC EMPRESS
321	79SUM			7942		COLLISION WITH AEGEAN CAPTAIN
322	79SUM					
323				7944		
324	79SUM					2ND SPILL - 1ST ON 7/19/79 DUE TO COLL. W/ AEGEAN CAPTAIN
325				7948		
326	79SUM			7949		SINGLE POINT MOORING, TOWED 90 MI. TO SEA, SUNK NW PT. NOIRE
327	79SUM			7950		
328				7952		CARGO CRUDE OIL UNTOUCHED
329				79-53		
330	79SUM		2686	7954		4 SHELL OIL COMPANY BARGES ALSO INVOLVED
331				7956		
332				7957		
333			2863			
334	79SUM			7958		OSIR CRUDE&GASOIL.IFP CRUDE. DUPLICATE FO REC. - HEAVY FUEL
335						
336				7959		
337	79SUM			7960		OSIR SHOWS AS 10/10/79
338			2574			
339				7964		
340	79SUM			7967		AGROUND 6 MI. FROM ENTRANCE OF GALVESTON BAY NEW DAY
341				7968		
342				7971		
343	79SUM			7972		COLLISION W/ORE VES. EVRIALY
344				7973		
345				7974		RENAMED MALDEA
346	79SUM					
347				7975		
348	79SUM			7977		
349	79SUM		882	7978		
350	79SUM			7979		
351				7980		
352	LLP-405			8002		
353	80SUM		2011			
354	80SUM		8005			
355				8004		

	REFERENCE SOURCE					
	OSIR	OSB	COUARD	IFP	GOLOB	COMMENTS
356	80SUM					
357	80SUM			8007		
358			2125	8006		
359				8008		
360						
361	80SUM			8010		
362	9.13,15 10.13,33			8011		NEAR ILE DE BATS. LLP SAYS MADAGASCAN. 1980 OSIR SUM
363				8012		SANK 40 SECONDS AFTER EXPLOSION
364				8015		
365	1980 SUMMARY IV40			8014		
366	80SUM		2162			IR HAD 3/15/80, BRIMSTONE (TUO)
367	80SUM			8018		
368				8019		
369				8020		
370	80SUM		1348			
371	80SUM					
372	80SUM		234	8022		CO RANGE OIL,IFP HAS CRUDE,OSIR UNDET. GUAM WAS PART OF U.S.
373	80SUM		2459			
374	80SUM					
375				8025		
376	80SUM					
377	80SUM			8026		
378				8028		
379	80SUM			8031		
380	80SUM					
381	80SUM			8034		
382	80SUM					
383	80SUM			8038		
384	80SUM		23			
385	80SUM					
386	80SUM					
387	80SUM			8045		ACCIDENT WITH NORDIC FAITH VOLUME IS CLOSE TO OSIR'S COMB.
388	80SUM					SPILL WITH TANKER STAWANDA VOLUME IS OSIR'S FOR COMBINED
389				8047		
390	80SUM					
391	80SUM		1132	8048		
392	80SUM		8677	8049		
393				8051		
394	80SUM		2221	8052		
395	80SUM			8053		
396	80SUM					
397	80SUM					
398				8058		
399				8103		SPRANO LEAK SANK A LAGUNA MADRE, MEX. 100 MI. S OF BROWNSVLL
400	4.3,4 9.13,15			8104		
401	4.3		1462			
402	3.5		905	8107		IR AND IFP HAD CONCHO,CO HAD BRADFORD ISLAND
403	4.6,7		364	8110		
404				8115		
405	4.9			8116		
406	5.32					
407	5.32		1320			
408	4.13 81SUM		2255			EDIT 449IR HAD 1500 BBL
409	4.13					
410	81SUM			8121		TOWED 26 MI. TO SEA, DRIFTED 3 MOS., SUNK BY FR. NAVY 7/5/81
411	81SUM			8124		
412			1558			
413				8125		ST. VINCENT
414				8127		
415				8129		
416				8134		
417	4.27		269			
418				8137		
419				8138		
420	4.29			8139		
421				8140		
422	81 SUMMARY V32			8142		
423	4.35			8146		
424				8148		
425				8153		
426	4.47,9.13			8154		

	REFERENCE SOURCE					
	OSIR	OSB	COUARD	IFP	GOLOB	COMMENTS
427	81 SUMMARY V32			8159		
428				8158		IFP-BUNKER, LLP UNLOADING CARGO OF CRUDE OIL-NO SPILL IDENT.
429				8161		
430				8204		
431				8205		
432	5.8			8208		
433	5.11					
434				8210		
435	5.14			8213		
436	5.15		357	8214		IR HAS 1500 BBLS
437				8215		
438				8216		
439				8217		
440			664			
441	5.24			8225		IFP HAD 6/14/82
442	5.27					
443	5.27, 5.28		4524	8227		DUPLICATE TO THE BU42 BARGE SPILL?
444			1198	8227		10,000 BBL AT MI. 6.0 6/29, 18,144 BBL AT MI. 66.0 6/27
445				8228		
446				8229		
447			1462			
448			1052			
449			578			
450	5.31,33			8233		COLLISION W/CHINESE SHIP HU LENG SI HAO
451	5.34			8235		
452	5.41			8240		
453				8242		
454	5.46			8244		
455	5.47		1140			
456				8246		
457				8251		

Spill Inventory for January 1, 1983 to June 15, 1990

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
1	7	1	83	ASSIMI	T	GRE	59,000	33,847	64	FULL	51,566	51,566	51,566	1	IRANIAN CRUDE	F	24:25N	058:08E	103	RAS AL HADD, 58 MI. FROM MUSCAT
2	12	1	83	MARIN MIST (BARGE)	B	USA	0	0	0		1,995	1,995	1,995	2	FUEL OIL	T	UNSP	UNSP	121	PORT, CALIFORNIA
3	19	1	83	NIKOS M	T	GRE	233,000	0	71		490	490	490	1	CRUDE	F	UNSP	UNSP	0	GULF OF ADEN, DJIBOUTI WATERS
4	20	1	83	TIPOSO	T	LIB	138,823	68,631	74	BALLAST	295	295	295	2	DIESEL FUEL/BUNKER	F	33:18N	063:33W	115	11 MI N OF BERMUDA
5	30	1	83	HOZAN MARU 8	T	JAP	1,000	0	77		499	499	499	2	GASOLINE	F	UNSP	UNSP	130	PACIFIC O.?, OFF JAPAN
6	1	2	83	ARABIAN SEA	T	SAF	310,714	0	0		298	298	298	1	LIGHT ARABIAN CRUDE	F	23:48S	045:26W	376	SAO SEBASTIAO, BRAZIL
7	9	2	83	NOVOROSSISKIY PARTIZ	T	RUS	36,000	0	63		499	499	499	2	BUNKER FUEL	F	41:00N	029:30E	178	BOSPHORUS STRAIT, OFF TURKEY
8	28	2	83	HONAM JADE	T	LIB	183,553	0	76	FULL	2,021	1,995	2,021	1	HEAVY ARABIAN CRUDE	F	34:50N	127:30E	132	1.6 KM OFF YOSU, S. KOREA
9	2	4	83	V882,883,884,885 (BARGE)S	B	USA	2,000	0	0	FULL	675	675	2,177	1	CRUDE	T	UNSP	UNSP	118	U. MISS. R. MI. 179.2 ST. LOUIS, MO
10	22	4	83	LAURA SECURITY	T	PAN	1,000	757	56		598	583	598	2	FUEL OIL	F	UNSP	UNSP	141	REEF, S.GULF OF SUEZ - RED SEA, EGYPT
11	25	4	83	TT 7001 (BARGE)	B	USA	0	0	0		272	272	272	2	NO. 6 FUEL	T	39:37N	040:49W	118	ILLINOIS R. MI. 56.0 FLORENCE, ILL.
12	28	4	83	KIRISHIMA MARU NO. 11	T	JAP	1,624	0	0		139	139	139	2	NAPHTHALINE	F	UNSP	UNSP	131	550 METERS OFF YOKOHAMA, JAPAN
13	15	5	83	BELLONA	T	NOR	3,000	0	65		499	499	499	2	FUEL OIL	F	UNSP	UNSP	215	BALTIC SEA, SWEDEN
14	20	5	83	AL DURIYAH	T	LIB	302,382	0	75	FULL	1,613	1,197	1,613	1	HEAVY ARABIAN CRUDE	F	UNSP	UNSP	141	MADIQ GUBAL, GULF OF SUEZ
15	3	6	83	(TANK SHIP)	T	UNS	0	0	0		163	163	163	1	CRUDE	T	27:50N	097:14W	82	NEAR CORPUS CHRISTI, TX
16	9	6	83	SF171 & SF172 (BARGE)S	B	USA	0	0	0	FULL	1,911	1,911	1,995	2	NO. 6 FUEL	T	UNSP	UNSP	118	MILE 435.8 MISS. RIVER
17	28	6	83	PETER MAERSK	T	DAN	47,803	29,660	0		136	136	136	2	NO. 6 FUEL	T	34:07N	077:56W	116	CAPE FEAR RIVER, NC
18	16	7	83	MANHATTAN DUKE	T	LIB	82,000	39,349	76	BALLAST	499	499	499	2	BUNKER FUEL	F	09:50S	147:30E	321	BASILISK REEF,PORT MORESBY,N.GUINEA
19	6	8	83	CASTILLO DE BELLVER	T	SPA	271,540	138,822	78	FULL	189,483	159,565	254,292	1	ARABIAN CRUDE	F	33:11S	017:06E	442	75 KM S. AFRICA, NW CAPE TOWN
20	13	8	83	EIKO MARU NO. 1	T	JAP	0	999	0		356	308	359	2	FUEL OIL	F	38:00N	141:00E	130	OFF SHIOGAMA & KARAKUWAZAKI, JAPAN
21	26	8	83	BAILEY	T	PA?	28,234	0	0		259	259	259	2	BUNKER C	F	34:32N	139:16E	131	3.9K M OFF MIKOMOTOSHIMA, JAP.
22	17	9	83	EPTANISSOS	T	GRE	53,180	0	0		327	327	327	1	VENEZUELAN CRUDE	F	10:24N	075:33W	43	NEAR CARTEGENA, COLUMBIA
23	26	9	83	MATTHEWCHRISTINA (BARGE)	B	USA	6,000	0	0	FULL	777	698	842	2	GASOLINE: AVIATION	T	41:30N	074:00W	152	RIVER, NEWBURGH, NEW YORK
24	27	9	83	SIVAND	T	IRA	218,587	0	71		6,155	6,155	8,976	1	LIGHT CRUDE	F	53:36N	000:11W	181	IMMINGHAM, ENGLAND
25	29	9	83	GERHARD	T	WGE	4,155	0	81	FULL	431	431	499	2	LIGHT DIESEL	F	50:31N	002:27W	181	10 KM OFF PORTLAND BILL, ENG.
26	6	10	83	THEODEGMON	T	GRE	35,363	19,674	60	FULL	408	408	499	1	VENEZUELAN CRUDE	F	08:17N	062:44W	6	ORINOCO R, NEAR PUERTO ORDAZ, VENEZ
27	18	10	83	MONEMVASIA	T	GRE	128,366	0	73	FULL	4,085	4,085	4,189	1	INDONESIAN CRUDE	F	01:16N	104:48E	26	SOUTH CHINA SEA, NR. SINGAPORE
28	19	11	83	BLUE MAGPIE	T	PAN	7,060	3,801	82	BALLAST	243	243	243	2	BUNKER C/FUEL OIL	T	44:37N	124:05W	157	YAQUINA BAY, NEAR NEWPORT, OREGON
29	25	11	83	FEOSO AMBASSADOR	T	PAN	44,498	24,825	61	FULL	2,857	2,857	3,989	1	CRUDE	F	36:04N	120:22E	132	QINGDAO, S CHINA SEA OFF HONG KONG
30	26	11	83	PNOC BASILAN	T	PHI	16,346	10,945	62	FULL	17,007	16,954	17,007	2	KEROSENE & GASOLINE	F	16:21N	120:19E	60	S CHINA SEA OFF AGOO, PHILLIPINES
31	7	12	83	IRVING ESKIMO	T	UNS	38,213	0	0		136	136	136	2	FUEL OIL	F	UNSP	UNSP	151	ST. LAWRENCE RIVER, NR QUEBEC
32	10	12	83	PERICLES G. C.	T	GRE	60,044	38,915	67	FULL	38,912	38,912	46,174	1	LIGHT ARABIAN CRUDE	F	25:34N	052:03E	103	ARABIAN GULF, 200 MI ENE DOHA QATAR
33	22	12	83	SAN NIKITAS	T	GRE	27,000	16,417	64	UNSP	499	499	499	2	BUNKER FUEL	F	61:10N	018:24E	251	GULF OF BOTHNIA, BALTIC SEA, SWEDEN
34	25	12	83	US 218 (BARGE)	B	USA	0	0	0		3,401	340	3,401	2	LIGHT DIESEL NO. 1-D	T	30:05N	091:00W	118	LOWER MISS. R. MI 180.8 DONALDSON LA
35	27	12	83	NAGATO MARU 6	T	JAP	2,000	0	82		499	499	499	2	KEROSENE	F	UNSP	UNSP	130	PACIFIC O., STRAIT OFF JAPAN
36	20	1	84	SITIAWAN	T	MLS	2,000	0	69		499	499	499	2	FUEL OIL	F	UNSP	UNSP	0	S. CHINA SEA?, PORT OFF MALAYSIA
37	22	1	84	CEPHEUS	T	GRE	28,000	0	71	FULL	713	499	713	2	KEROSENE/JET A FUEL	T	61:15N	149:55W	231	2.5 KM FROM ANCHORAGE NR PALMER, AK
38	22	1	84	FLAMMULINA	T	USA	32,229	19,274	0		204	183	204	2	GASOLINE	T	40:35N	074:14W	152	CARTERET & ARTHUR KILL, NJ
39	24	1	84	(BARGE)	B	UNS	0	0	0		3,554	3,554	3,554	2	NO. 6 FUEL	T	UNSP	UNSP	118	LOWER MISSISSIPPI R. MI. 694.5, AR
40	16	2	84	HOEGH MASCOT	T	NOR	0	0	0		2,268	2,268	2,268	2	CLARIFIED	T	43:20N	124:20W	157	OUTSIDE COOS BAY, OREGON
41	26	2	84	CHEM 102(BARGE)	B	USA	33,696	0	0		1,882	490	1,882	1	CRUDE & MINERAL SEAL	T	UNSP	UNSP	81	LOWER MISSISSIPPI R. MI. 123.0, LA
42	27	2	84	AMERICAN EAGLE	T	USA	36,000	20,520	59	BALLAST	499	499	499	2	BUNKER FUEL	T	27:30N	090:31W	82	180 MI. SW OF NEW ORLEANS, LA
43	29	2	84	BUTE NO. 3 (BARGE)	B	CAN	0	0	0		172	172	172	2	DIESEL FUEL GASOLINE	F	53:28N	131:58W	194	GRAHAM I., BRITISH COLUMBIA
44	4	3	84	STOLT OSPREY	T	LIB	0	0	0		761	761	761	2	PARAFFIN	F	35:32N	139:41E	131	OFF YOKOHAMA, JAPAN
45	7	3	84	TANKER	T	UNS	0	0	0		483	483	483	2	KEROSENE	F	UNSP	UNSP	325	SOUTHERN SUMATRA, INDONESIA
46	19	3	84	MOBIL OIL	T	USA	31,760	18,615	59	FULL	680	544	680	2	NO. 6 FUEL CLARIFIED	T	45:50N	122:47W	157	MI.88 COLUMBIA R. NEAR PORTLAND, OR
47	19	4	84	(BARGE)	B	USA	0	0	0		146	146	146	2	NO. 6 FUEL	T	UNSP	UNSP	118	MI 22.5 ARKANSAS RIVER ARKANSAS
48	2	5	84	OFFSHORE 2403	T	USA	0	0	0		380	380	380	2	JP5 JET FUEL (KERO.)	T	32:27N	122:02W	121	CALIFORNIA?
49	4	5	84	TANK SHIP	T	UNS	0	0	0		257	256	257	2	DIESEL NO. 1-D	T	27:49N	082:25W	81	TAMPA BAY, FLORIDA
50	14	5	84	HAEKWANG NO. 1	T	KOR	0	0	0		191	191	191	2	FUEL	F	34:50N	127:30E	132	YOSU, SOUTH KOREA
51	28	6	84	BETTENDORF (BARGE)	B	USA	0	0	0		218	217	218	2	NO. 2 FUEL	T	UNSP	UNSP	118	MI. 363.7 UPP. MISSISSIPPI R., IA
52	1	7	84	ARCTIC LINK	T	UNS	0	0	0		590	590	590	2	BUNKER DIESEL LUBE	F	54:18N	058:00W	186	LAKE MELVILLE, LABRADOR
53	6	7	84	HOSEI MARU	T	JAP	2,000	0	80	FULL	2,498	1,795	2,498	2	GASOLINE KEROSENE	F	34:32N	138:17E	131	OFF HONSHU, JAPAN
54	14	7	84	TURPIAL	T	VEN	18,130	10,734	0		162	82	272	2	HEAVY FUEL NO. 6	T	29:44N	095:08W	82	HOUSTON SHIP CHANNEL, TEXAS
55	28	7	84	PERITO MORENO	T	ARG	20,000	12,443	67	PARTIAL	598	598	0	2	FUEL OIL	F	34:30S	058:00W	413	BUENOS AIRES, ARGENTINA
56	30	7	84	ALVENUS	T	BRI	57,375	0	79	FULL	9,041	4,082	10,001	1	MEREY & PILON CRUDE	T	29:35N	093:16W	82	18 KILOMETERS SOUTH OF CAMERON, LA
57	7	8	84	SOMA MARU (CARGO VESSEL)	T	JAP	0	0	0		648	648	648	2	BUNKER A & B	F	35:32N	140:45E	130	OFF KAWASAKI, JAPAN
58	20	8	84	GLORY	T	TAI	100,000	0	76	FULL	2,041	1,995	2,041	1	CRUDE	F	26:41N	050:11E	103	RAS TANURA, SAUDI ARABIA
59	28	9	84	JACUI	T	BRA	129,000	0	78	FULL	761	761	798	1	CRUDE	F	36:04N	120:22E	132	QINGDAO, CHINA
60	16	10	84	ROVER STAR	T	PAN	52,000	25,457	66	BALLAST	997	997	997	2	BUNKER FUEL	F	24:06N	058:45E	103	GULF OF OMAN, 30 MI. OFF MUSCAT
61	19	10	84	FAHIRE GUNERI	T	TUR	89,000	0	68	FULL	577	577	598	1	CRUDE	F	38:50N	026:56E	142	OFF IZMIR, TURKEY
62	20	10	84	CHEM 13 (BARGE)	B	USA	0	0	0		356	356	356	2	NO. 2 FUEL	T	38:40N	090:15W	118	MI 178.3 UPP. MISS. R. ST. LOUIS,MO
63	24	10	84	LAJPAT RAI	T	IND	49,000	28,812	65	PARTIAL	9,973	9,973	9,973	1	CRUDE	F	19:00N	073:00E	65	BUTCHER I. OIL TERM., BOMBAY, INDIA
64	29	10	84	USS ROANOKE	T	USA	38,000	0	76		1,213	347	9,932	2	JP-5 NAVAL/KEROSENE	T	21:22N	158:00W	88	ENTRANCE TO PEARL HARBOR, HA
65	31	10	84	PUERTO RICAN	T	USA	35,240	20,295	71	FULL	4,049	340	6,531	2	BUNKER LUBE REF.PDTS	T	37:45N	122:42W	121	11 MI W. OF SAN FRANCISCO, CA
66	2	11	84	CATHERINE Y	T	PAN	21,000	12,575	60	BALLAST	499	499	499	2	BUNKER FUEL	F	12:30N	087:00W	45	PACIFICO 3 MI.OFF CORINTO,NICARAGUA
67	21	11	84	REB 901 (BARGE)	B	USA	0	0	0		198	198	198	2	LUBE	T	UNSP	UNSP	117	MILE 24 OHIO RIVER
68	21	11	84	DEFIANCE	T	USA	0	0	0		2,313	2,313	2,313	2	NO. 6 FUEL OIL	T	33:59N	077:58W	116	CAPE FEAR, NORTH CAROLINA
69	25	11	84	IBN ROCHD	T	MOR	23,000	0	77		499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	215	BALTIC SEA OFF DENMARK
70	26	11	84	ALMAK	T	BRI	57,000	0	78		3,401	2,294	3,401	1	CRUDE	F	12:10N	069:00W	43	CURACAO, WEST INDIES
71	16	12	84	(BARGE)	B	USA	0	0	0		742	742	742	2	GASOLINE: AVIATION	T	29:22N	094:53W	82	GULF OF MEXICO, TX

Spill Inventory for January 1, 1983 to June 15, 1990

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
72	22	12	84	TENSHO MARU (CARGO VES.)	T	JAP	0	0	0		486	486	486	2	BUNKER A & B FUEL	F	34:33N	138:41E	131	OFF HONSHU, JAPAN
73	2	1	85	2 BARGES	B	USA	0	0	0		136	136	136	2	NAPHTHA	T	30:05N	093:43W	118	SABINE R., NEAR ORANGE, TEXAS
74	26	1	85	BARGE (PONTON)	B	UNS	0	0	0		654	654	654	1	CRUDE	F	UNSP	UNSP	25	EAST KALIMANTAN, INDONESIA
75	30	1	85	(BARGE)	B	UNS	0	0	0		619	619	619	1	CRUDE	F	UNSP	UNSP	25	EAST KALIMANTAN, INDONESIA
76	12	2	85	BW 1933 (BARGE)	B	USA	0	0	0		544	544	544	2	JP-5 JET FUEL	T	UNSP	UNSP	118	LOWER MISS. R. MI. 791, TENNESSEE
77	27	2	85	SANSHO MARU	T	JAP	2,000	0	78		499	499	499	2	KEROSENE	F	UNSP	UNSP	130	PACIFIC O., OFF JAPAN
78	4	3	85	PUNTA DELGADA	T	ARG	4,000	3,210	45	PARTIAL	1,995	1,995	1,995	2	NAPHTHA/PARRAFIN	F	34:40S	058:00W	413	LA PLATA ROADS,NR BUENOS AIRES, ARG
79	5	3	85	HOLLYWOOD 2006 (BARGE)	B	USA	0	0	0		136	130	136	1	LIGHT CRUDE	T	29:41N	091:13W	82	MILE 110 ATCHAFOLAYA RIVER, LA
80	5	3	85	KOSHUN MAR	T	JAP	0	0	0		972	972	972	2	FUEL A	F	35:32N	139:49E	131	TOKYOWAN, JAPAN
81	6	3	85	LYUDIK SVOBODA	T	RUS	16,000	10,994	84	PARTIAL	4,986	4,986	4,986	2	FUEL OIL	F	57:10N	021:10E	214	BALTIC SEA AT VENTSPILS, LATVIA
82	16	3	85	EKFJORD	T	SWE	2,000	0	77		499	499	499	2	FUEL OIL	F	UNSP	UNSP	215	BALTIC SEA, SWEDEN
83	16	3	85	21 SANYO MARU	T	JAP	1,000	0	76	FULL	648	499	648	2	FUEL A	F	32:12N	129:31E	132	EAST CHINA SEA OFF KYUSHU, JAP
84	17	3	85	MARINA	T	GRE	98,000	0	80	FULL	2,381	2,381	2,493	1	CRUDE	F	23:48S	045:26W	376	SAO SEBASTIAO, BRAZIL
85	21	3	85	PATMOS	T	GRE	111,000	51,627	69	FULL	698	698	1,905	1	CRUDE	F	38:00N	015:00E	143	STRAIT OF MESSINA OF SICILY
86	8	4	85	FUJI	T	PAN	32,000	17,742	75	BALLAST	499	499	499	2	FUEL OIL	F	32:30N	071:30W	116	20 MI. SE OF CAPE HATTERAS, NC
87	11	4	85	NAPO	T	ECU	32,000	0	81		499	499	499	2	FUEL OIL	F	UNSP	UNSP	44	CARRIBEAN, CUBA
88	30	4	85	GOLAR PETROTRADE	T	LIB	0	0	0		165	165	170	2	LUBE OIL ADDITIVE	F	51:55N	004:29E	216	ROTTERDAM, THE NETHERLANDS
89	9	5	85	TEXACO 803 (BARGE)	B	USA	0	0	0		143	143	143	2	NO. 2 DIESEL	T	40:44N	074:07W	152	BAYONNE, NEW JERSEY
90	23	5	85	CHOTIN 1451 (BARGE)	B	USA	0	0	0		354	353	354	2	NAPTHA: SOLVENT	T	UNSP	UNSP	81	GULF INTERCOASTAL WTRWY. MI 123, LA
91	26	5	85	CAMPONAVIA	T	SPA	6,000	4,222	73	PARTIAL	997	997	997	2	GASOLINE	F	36:08N	005:27W	109	ALGECIRAS BAY, SPAIN
92	26	5	85	PETROGEN (PETRAGEN) ONE	T	PAN	30,000	19,070	82	FULL	5,034	103	5,034	2	BUNKER/NAPTHA	F	36:08N	005:27W	109	ALGECIRAS, SPAIN
93	16	6	85	BRIDGENESS	T	BRI	1,000	0	69	FULL	196	149	598	2	HEAVY FUEL OIL	F	51:44N	005:02W	181	IRISH SEA-17 MI PEMBROKESHORE,WALES
94	26	6	85	KINSEI MARU	T	JAP	3,000	0	76		2,721	2,721	2,721	2	KEROSENE	F	33:59N	130:50E	131	SEA OF JAPAN
95	5	7	85	COWREH (BARGE)	B	SL.	1,000	0	70		499	499	499	2	FUEL OIL	F	UNSP	UNSP	2	ATLANTIC O., SIERRA LEONE
96	8	7	85	AL AKABAR 2	T	ARA	1,000	0	62		798	798	798	2	FUEL OIL	F	UNSP	UNSP	102	N. INDIAN OCEAN, PAKISTAN
97	13	7	85	(BARGE)	B	UNS	0	0	0		3,401	3,401	3,401	2	MINERAL SEAL	T	29:17N	094:54W	82	NEAR BAYTOWN & GALVESTON, TX
98	2	8	85	JAN	T	WGE	0	1,400	0		290	294	317	2	HEAVY FUEL OIL	F	57:03N	009:56E	216	NE COAST, JUTLAND, DENMARK
99	17	8	85	RF-1001 (BARGE)	B	USA	0	0	0	FULL	1,224	1,224	1,296	2	SLURRY OIL/HVY NO. 6	T	29:55N	089:55W	81	CHALMETTE, LA, 1 MI. N., MISS.
100	18	8	85	EXXON NO. 32 (BARGE)	B	USA	0	0	0		4,082	4,082	4,082	2	NO. 2 FUEL	T	37:06N	076:30W	116	OFF NORFOLK, VA
101	12	9	85	SOTKA	T	FIN	0	16,000	0		290	294	308	2	HEAVY FUEL OIL	F	60:18N	019:08E	231	ALAND SEA W. OF ECKERO ISLAND
102	14	9	85	SINODA	T	LIB	28,000	16,423	74	EMPTY	499	499	499	2	BUNKER FUEL	F	33:30N	139:30E	131	IZU I., 30 MI. FR MIKURASHIMA, JAP
103	15	9	85	KAZIMIERZ PULASKI	T	POL	0	0	0		259	259	259	2	NO. 6 FUEL OIL	T	40:39N	074:08W	152	KILL VAN KULL R., BAYONNE, NJ
104	28	9	85	GRAND EAGLE	T	PAN	81,281	0	81	FULL	1,409	1,296	1,409	1	MINAS HEAVY CRUDE	T	39:48N	075:25W	116	MARCUS HOOK, PA DELEWARE RVR
105	22	11	65	E-24 (BARGE)	B	USA	0	1,457	63	FULL	2,728	136	2,728	2	NO. 6 AND NO. 2 FUEL	T	41:20N	072:00W	152	ENTRANCE TO LONG ISLAND SOUND
106	24	11	85	SFI 41 (BARGE)	B	USA	0	0	0		2,218	972	2,218	2	NO. 6 OIL	T	37:13N	089:27W	117	MI. 43.7 UPPER MISS. R.-THEBES BR.
107	3	12	85	POINTE LEVY (BARGE)	B	UNS	0	0	0		272	156	272	2	BUNKER C	F	48:51N	067:33W	151	MATANE, QUEBEC GULF OF ST. LAWRENCE
108	6	12	85	BOTANY TRIAD	T	PAN	6,000	0	82	FULL	875	875	997	2	LIGHT FUEL OIL	F	34:21S	024:27E	441	OFF CAPE ST. FRANCIS, S.AFRICA
109	6	12	85	NOVA (NOYA?)	T	LIB	239,435	105,286	75	FULL	70,952	69,167	69,810	1	IRANIAN LIGHT CRUDE	F	28:00N	051:00E	103	140KM S OF KHARG IS ARAB. GULF
110	13	12	85	AMERICAN LEGION	T	USA	0	18,764	0		259	259	259	2	NO. 6 FUEL/BUNKER C	T	13:27N	144:39W	51	ENTRANCE TO APRA HARBOR, GUAM
111	16	12	85	TANKER?	T	USA	0	0	0		374	374	374	2	GASOLINE	T	27:30N	097:31W	82	RIVER NEAR CORPUS CHRISTI, TX
112	17	12	85	DXE 3006 (BARGE)	B	USA	0	0	0		585	583	585	1	CRUDE	T	37:12N	089:27W	117	MI 43.7 U. MISS.R., IL THEBES BRIDGE
113	21	12	85	ARCO ANCHORAGE	T	USA	122,249	0	73		774	612	884	1	ALASKAN CRUDE	T	48:08N	123:26W	157	PORT ANGELES, PUGET SOUND, WA
114	31	12	85	POLGOET	T	FRE	0	14,545	0		299	294	334	2	HEAVY FUEL OIL	F	47:19N	002:04W	145	DONGES, ST. NAZAIRE, FRANCE
115	3	1	86	BRADIA (BRADY) MARIA	T	PAN	0	996	0		199	199	249	2	CARGO OIL	F	UNSP	UNSP	216	RIVER ELBE S. OF KIEL CANAL ENTRANC
116	26	1	86	ORLEANS	T	GRE	155,106	0	71		1,973	997	10,286	1	LIGHT CRUDE	F	UNSP	UNSP	216	OFF NORFOLK COAST OF ENGLAND
117	4	2	86	B.F.T. #24 (BARGE)	B	USA	0	0	0		476	136	476	2	NO. 6 FUEL	T	42:20N	071:01W	151	SOUTH BOSTON HARBOR, MA
118	7	2	86	ST. THOMAS (BARGE)	B	USA	0	0	0		204	133	204	2	#5 MEDIUM FUEL	T	18:20N	065:00W	43	CROWN BAY, ST. THOMAS, VIRGIN ISL.
119	11	2	86	LINDSEY FRANK	T	UNS	0	0	0	UNSP	243	243	243	1	CRUDE	T	40:40N	074:15W	152	KILL VAN KULL R., NY NR STATEN I.
120	7	3	86	TEXAS (BARGE)	B	USA	0	0	0		1,224	1,224	1,224	1	CRUDE	T	37:12N	089:27W	117	UPPER MISS. R. MI. 43.4, THEBES, IL
121	21	3	86	INTERMAR ALLIANCE	T	LIB	80,000	0	81	FULL	340	340	544	1	NIGERIAN/NINIAN CRUDE	T	39:47N	075:26W	116	MARCUS HOOK, PA--DELAWARE RIVER
122	17	5	86	VALPARAISIO	T	CHI	128,000	58,123	71	FULL	2,041	1,959	2,041	1	EGYPT CRUDE	F	38:21S	074:00W	415	180 MI S OF PORT TALCAHUANO, CHILE
123	4	6	86	SOUTHERN CROSS	T	BAH	32,000	18,483	77	PARTIAL	7,978	7,978	7,978	2	FUEL OIL	F	UNSP	UNSP	144	MEDITERRANEAN, ALGERIAN PORT SKIKDA
124	22	6	86	LUKHOVITSY	T	RUS	38,000	0	65		1,156	1,156	1,197	2	CARGO FUEL OIL	F	22:OON	082:00W	81	CUNFUEGOS (CIENFUEGOS) HARBOUR,CUBA
125	9	7	86	PANTAS	T	SIN	5,000	2,907	71	FULL	1,995	1,995	1,995	2	GASOLINE	F	01:45N	102:40E	26	STR. OF MALACCA OFF BATU PAHAT
126	31	7	86	TTT-103 (BARGE)	B	USA	0	0	0		1,905	1,497	1,905	2	GAS,NO. 2 FUEL & LPG	T	30:26N	088:33W	117	INTERCOAST. WTRWY., PASCAGOULA, MS
127	2	8	86	GOLDEN PEACE 101 (BARGE)	B	UNS	0	0	0		343	343	343	2	FUEL OIL	F	UNSP	UNSP	25	OFF SARAWAK, E.MALAYSIA LUTONG MIRI
128	16	8	86	MAYSUN	T	PHI	2,000	990	68	FULL	1,905	1,905	1,995	2	BUNKER C/FUEL OIL	F	UNSP	UNSP	60	55 MI OFF NOGAS ISLAND, PHILLIPINES
129	4	9	86	BARGE	B	UNS	0	0	0		256	256	256	2	P40 DIESEL	F	UNSP	UNSP	227	CANADA, NW TERRITORIES, HAY R.
130	10	9	86	VIKING OSPREY	T	SIN	81,000	0	81		857	340	859	1	ISTHMUS LIGHT CRUDE	T	39:50N	075:25W	116	MARCUS H,DELAWARE R,GIBBSTOWN,NJ/PA
131	17	9	86	ST-85 (BARGE)	B	USA	0	0	0		389	198	389	2	GASOLINE: AUTOMOTIVE	T	41:37N	070:42W	152	BUZZARDS BAY, WEST FALMOUTH, MA
132	7	10	86	HUA YUN 4	T	TAI	8,000	0	84		1,182	1,182	1,183	2	KEROSENE/CARGO FUEL	F	UNSP	UNSP	131	OFF SHIKOKU I, JAPAN
133	17	10	86	JORGEN J. LORENTZEN	T	SWE	134,000	0	75		162	162	1,620	1	CRUDE	T	29:05N	093:20W	82	GOM, 50 MILES SOUTH OF CAMERON, LA
134	27	10	86	IB 2903	T	USA	0	0	0		703	567	1,568	2	GASOLINE: AUTOMOTIVE	T	UNSP	UNSP	118	UPP. MISS. R. MI. 301, HANNIBAL, MO
135	30	10	86	BROTAS	T	BRA	0	0	0		3,210	3,210	3,210	1	CRUDE	F	UNSP	UNSP	0	BRAZIL
136	16	11	86	AMAZON VENTURE	T	LIB	0	0	0		343	342	343	2	NO. 6 FUEL OIL	T	40:35N	073:52W	152	NEW YORK HARBOR UPPER BAY
137	4	12	86	AMAZON VENTURE	T	LIB	67,000	0	75	FULL	1,620	1,620	1,620	2	NO. 6 FUEL OIL	T	32:07N	081:01W	117	RIVER AT SAVANNAH, GEORGIA
138	21	12	86	THUNTANK 5	T	SWE	5,000	2,866	69		199	130	598	2	BUNKER/#5 FUEL OIL	F	UNSP	UNSP	250	GULF OF BOTHNIA NR GAVLE HARB SWEDE
139	6	1	87	STUYVESANT	T	USA	228,274	0	77	FULL	2,041	2,041	2,041	1	NORTH SLOPE CRUDE	T	51:29N	136:16W	194	VALDEZ, AK, GULF OF ALASKA
140	13	1	87	TANKER?	T	USA	0	0	0		2,041	2,041	2,041	1	CRUDE	F	51:29N	136:16W	194	OFF BRITISH COLUMBIA (0-3 MI.)
141	20	1	87	HANA (BARGE)	B	USA	0	0	0		136	136	136	2	NO. 6 FUEL OIL	T	21:07N	157:27W	88	HONOLULU BTW OAHU & MOLOKAI, HAWAII
142	25	1	87	OLYMPIC DREAM	T	GRE	32,000	0	74	FULL	855	855	997	2	GASOLINE	F	51:20N	003:30E	216	3 MI. OFF VLISSINGEN, NETHERLANDS

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
143	30	1	87	MERCATOR	T	LIB	30,000	0	0		1,995	1,995	1,995	2	NAPHTHA	F	UNSP	UNSP	109	ATLANTIC O. OFF PORTUGAL
144	6	2	87	ANTONIO GRAMSCI	T	RUS	40,000	27,706	78	FULL	698	598	997	1	CRUDE	F	60:00N	026:00E	250	6 MI OFF PORVOO, GULF OF FINLAND
145	17	2	87	PETER R. HEARNE (BARGE)	B	USA	0	0	0		330	32	330	2	GASOLINE	T	41:25N	074:00W	152	WEST POINT, HUDSON RIVER, NY
146	17	2	87	TEXACO 807 (BARGE)	B	USA	0	0	0		978	978	978	2	NO. 2 DIESEL	T	40:46N	073:56W	152	MI. 7 LOWER BAY NEW YORK HARBOR, NY
147	30	4	87	CABO PILAR-CHILENA	T	CHI	0	0	0		178	178	178	1	CRUDE	F	UNSP	UNSP	451	QUINTERO, CHILE
148	15	5	87	ATHOS	T	FRE	275,000	0	0	FULL	490	490	499	1	CRUDE	F	51:50N	004:00E	216	EUROPORT TERM. ROTTERDAM, NETH.
149	26	5	87	NISA	T	POR	321,000	0	83		993	993	993	1	CRUDE	F	UNSP	UNSP	0	ATLANTIC OCEAN PORTUGESE WATERS
150	30	5	87	SKYRON	T	LIB	138,000	0	74		136	136	167	2	DIESEL OIL/FUEL	F	51:00N	001:00E	216	NORTH SEA, STR. OF DOVER, UK
151	23	6	87	FUYOH MARU/VITORIA	T	JAP	14,442	0	77	FULL	11,004	0	11,004	2	KEROSENE	F	49:30N	000:30E	180	SEINE R., NR LE HAVRE, FRANCE
152	2	7	87	GLACIER BAY	T	USA	81,000	0	70	FULL	674	421	707	1	NORTH SLOPE CRUDE	T	60:00N	151:40W	232	COOK INLET 8KM S. OF KENAI, AK
153	2	7	87	ELENI S.	T	PAN	2,000	1,399	44	FULL	1,795	997	1,795	2	DIESEL & FUEL OIL	F	06:23N	003:40E	36	12 MI. EAST OF LAGOS, NIGERIA
154	7	7	87	STOLT AVANCE	T	LIB	23,000	0	77		191	191	499	2	FUEL	F	01:11N	103:53E	26	STR. OF MALACCA, SINGAPORE
155	13	7	87	ERIK	T	PAN	3,000	0	68		499	499	499	2	FUEL OIL	F	UNSP	UNSP	0	N. SEA, GREAT BRITAIN
156	22	7	87	ELHANI	T	LIB	155,000	81,412	76	FULL	2,190	2,190	2,992	1	CRUDE	F	01:06N	103:46E	26	OUTSIDE SINGAPORE, INDONESIAN WATER
157	25	8	87	AKARI	T	PAN	2,000	1,345	64	FULL	1,007	997	1,995	2	HEAVY FUEL OIL	F	UNSP	UNSP	103	BETWEEN DUBAI & JEBEL ALI U.ARAB.E.
158	11	9	87	TOLMIROS (SUSPECTED)	T	UNS	0	0	0		214	214	214	1	CRUDE	F	57:30N	012:00E	215	NNE GOTHENBURG, SWEDEN KATTEGET
159	4	10	87	STUYVESANT	T	USA	228,274	0	77		1,944	1,795	2,268	1	NORTH SLOPE CRUDE	T	54:05N	138:00W	194	GULF OF AK, 100-200 MI. OFF BRIT C
160	7	10	87	CABO PILAR	T	CHI	70,000	0	71		4,704	4,704	6,981	1	CRUDE	F	53:00S	071:00W	487	PUNTA ARENAS, STRAIT OF MAGELLAN
161	20	12	87	VECTOR/COLL. W/ DONA PAZ	T	PHI	1,000	629	80	FULL	1,199	1,197	1,199	1	CRUDE OIL	F	12:30N	120:00E	60	PHILIPPINES BTW MINDORO-MARINDUQUE
162	3	1	88	EXXON BARGE NO. 241	B	USA	0	0	0		544	544	544	2	AUTOMOTIVE GASOLINE	T	35:00N	090:00W	117	MI. 735 LOWER MISS. R., MEMPHIS, TN
163	10	1	88	STOLT SEA	T	LIB	23,000	0	71		136	130	136	2	NO. 6 FUEL	T	29:50N	090:10W	82	ON MISSISSIPPI R. IN AVONDALE, LA
164	17	1	88	DOMAR 115 (BARGE)	B	USA	13,000	0	0	FULL	952	884	997	2	GASOLINE & DIESEL 2	T	30:12N	088:33W	117	PASCAGOULA, MS- HORN I. PASS OFF LA
165	31	1	88	MCN OIL BARGE #5	B	USA	0	0	0		217	153	447	2	GYLCOL GASOIL/BUNKER	T	48:30N	122:41W	157	SHANNON POINT, PUGET SOUND, WA
166	31	1	88	AMAZZONE	T	ITA	32,000	0	72		2,144	2,041	2,144	1	CRUDE	F	48:30N	005:00W	145	ATLANTIC, POINTE DU RAZ, BRITTANY
167	25	2	88	HAPPY KARI	T	UNS	0	0	0		1,020	1,020	1,020	1	CRUDE	F	22:00N	038:00E	105	JEDDAH, SAUDI ARABIA, RED SEA
168	21	4	88	ATHENIAN VENTURE	T	CYP	31,000	0	75		34,344	26,927	34,344	2	UNLEADED GAS/BUNKER	F	42:30N	049:30W	149	350-400 MI. SE OF CAPE RACE, NEWFO.
169	6	5	88	CZANTORIA	T	LIB	0	0	0		408	408	408	1	CRUDE	F	UNSP	UNSP	152	ST. ROMULAD, QUEBEC
170	1	7	88	GOLAR LIZ	T	LIB	272,000	0	81		476	476	490	1	CRUDE	F	01:06N	103:43E	26	SINGAPORE, NR STRAIT OF MALACCA
171	13	7	88	NORD PACIFIC	T	SIN	107,776	0	86		2,089	2,088	2,089	1	BEATRICE CRUDE	T	27:48N	097:24W	82	CORPUS CHRISTI, TX INNER HARBOR
172	21	8	88	BARGE #570	B	USA	0	0	0		220	220	221	2	NO. 2 FUEL OIL	T	70:14N	146:45W	267	BEAUPORT SEA NEAR PRUDHOE BAY, AK
173	24	8	88	EASTERN CARRIERS BARGE565	B	USA	0	0	0	FULL	687	599	687	2	80%DIESEL 20%GASOLIN	T	37:40N	076:20W	116	CHESAPEAKE BAY NEAR KILMARNOCK, VA
174	1	9	88	OSHIMA SPIRIT	T	PAN	90,000	0	66		4,762	4,762	5,034	1	CRUDE	F	53:00S	071:00W	487	PUNTA ARENAS-STR OF MAGELLAN, CHILE
175	3	9	88	EXXON PUERTO RICO	T	USA	38,000	0	75	FULL	3,129	3,129	3,129	2	CARBON BLACK FEEDSTK	T	29:55N	090:15W	82	KENNER BEND ANCHORAGE N.ORLEANS, LA
176	5	9	88	EXXON BARGE 303	B	USA	0	0	0		409	409	525	2	NO. 2 DIESEL	T	29:00N	087:00W	82	GULF OF MEXICO OFF TAMPA, FL
177	10	10	88	CENTURY DAWN	T	PAN	103,000	0	75		10,191	5,034	10,191	1	CRUDE	F	01:15N	103:59E	26	PORT, SINGAPORE WATERS
178	10	11	88	ODYSSEY	T	LIB	65,000	0	71		139,619	136,054	139,619	1	NORTH SEACRUDE	F	53:00N	045:00W	185	730 MI. NE OF ST.JOHNS,NEWFOUNDLAND
179	9	12	88	KASUGA-MARU #1	T	JAP	1,000	0	76		428	1,097	428	2	FUEL OIL/BUNKER C	F	35:30N	128:00W	132	KYOTO PREF, OFF KYOGA CAPE, JAPAN
180	23	12	88	BARGE NESTUCCA	B	USA	8,000	0	0	FULL	736	227	816	2	NO. 6 FUEL/BUNKER C	T	46:55N	124:13W	157	WESTPORT, WA 25 MI OFF GRAYS HARBOR
181	26	12	88	UMTB AMERICAN BARGE 283	B	USA	6,000	0	0		3,239	3,239	5,986	2	DIESEL FUEL	T	55:48N	156:46W	196	SOUTH OF SEMIDI ISLANDS, AK
182	3	1	89	THOMPSON PASS	T	USA	0	0	0		231	227	231	1	NORTH SLOPE CRUDE	T	61:05N	146:23W	231	PORT VALDEZ, AK
183	22	1	89	SHANTA SHIBANI 2	T	PAN	37,000	0	74		997	997	997	2	FUEL OIL	F	UNSP	UNSP	62	S.CHINA SEA, VIETNAM
184	22	1	89	CARIBBEAN NAVIGATOR	T	PAN	4,000	0	65		499	499	499	2	GASOLINE	F	UNSP	UNSP	8	PACIFIC O., PANAMA
185	28	1	89	BAHIA PARAISO SUPPLY SHIP	T	ARG	9,000	0	81	FULL	551	551	598	2	DIESEL & JET FUEL	F	60:00S	070:00W	522	600 MI. S. OF CAPE HORN, CHILE
186	15	2	89	MAASSLUIS	T	HOL	38,000	0	82		499	499	499	2	BUNKER FUEL	F	UNSP	UNSP	145	W. MEDITERRANEAN, ALGERIA
187	15	2	89	GRANTOR (BARGE)	B	DOM	2,000	0	0		2,194	2,194	2,194	2	FUEL OIL	F	UNSP	UNSP	43	CARIBBEAN SEA, SANTO DOMINGO
188	19	2	89	AO-S247,C245,375 (BARGE?)	B	USA	0	0	0		137	137	412	2	AUTOMOTIVE GASOLINE	T	39:00N	084:33W	117	MI. 472 OHIO RIVER
189	21	2	89	CAPITAN W ARVELO	T	DOM	0	0	0		598	598	598	2	FUEL OIL	F	UNSP	UNSP	43	CARIBBEAN SEA, SANTO DOMINGO
190	24	3	89	EXXON VALDEZ	T	USA	211,000	0	86	FULL	32,721	18,095	36,281	1	NORTH SLOPE CRUDE	T	61:02N	146:05W	231	BLIGH REEF, P. WILLIAM S. VALDEZ AK
191	3	4	89	RHEINTANK 24	T	WGE	0	0	0		1,197	1,197	1,197	2	HEAVY HEATING OIL	F	50:00N	008:00E	216	RHEIN R-40 KM SW OF FRANKFURT,W.GER
192	13	4	89	ENTERPRISE	T	BRI	19,000	0	68		249	228	249	2	BUNKER C	F	29:00N	048:00E	104	AHMADI, KUWAIT
193	26	4	89	KANCHENJUNGA	T	IND	284,000	0	75		12,634	12,634	14,959	1	IRAQI LIGHT CRUDE	F	21:25N	039:02E	105	JEDDAH, SAUDI ARABI 6 MI. FROM PORT
194	6	5	89	BARGE #45	B	USA	0	0	0		253	253	253	2	GASOLINE	T	42:20N	073:50W	152	HUDSON, R. NEAR CATSKILL, NY
195	20	6	89	RHEINTANK 20	T	WGE	0	0	0		470	470	470	2	MOTOR FUEL/GASOLINE	F	UNSP	UNSP	216	NEAR GINSHEIM-GUSTAVSBURG, GERMANY
196	23	6	89	WORLD PRODIGY	T	GRE	24,990	0	86	FULL	1,361	935	1,361	2	NO. 2 FUEL OIL	T	41:30N	071:20W	152	NARAGANSETT BAY, RI BRENTON REEF
197	23	6	89	COASTAL TOWING BARGE 2514	B	USA	0	0	0	FULL	816	798	972	2	SLURRY/FUEL OIL	T	29:40N	094:40W	82	GALVESTON BAY, TX
198	24	6	89	PRESIDENTE RIVERA	T	URU	86,000	29,531	81		972	972	1,004	2	NO. 6/NO. 2 FUEL OIL	T	39:50N	075:25W	116	MARCUS HOOK, PA -DELAWARE RIVER
199	27	6	89	TWE 23 DE AGOSTO	T	CUB	4,000	0	88		1,995	1,995	1,995	2	GASOLINE	F	UNSP	UNSP	45	CARIBBEAN SEA, PORT IN CUBA
200	28	6	89	PUPPY P	T	MAL	30,000	0	70		5,485	5,485	5,485	2	FUEL OIL	F	UNSP	UNSP	328	MID-N. INDIAN OCEAN, INDIA
201	14	7	89	MARAO	T	POR	135,000	0	73		5,034	5,034	5,034	1	CRUDE	F	UNSP	UNSP	0	PORTUGESE ATLANTIC
202	25	7	89	NANCY ORR GAUCHER	T	LIB	0	2,899	0	PARTIAL	249	249	249	2	ASPHALT	F	43:30N	079:40W	152	HAMILTON HARBOR, ONTARIO, CANADA
203	6	8	89	VISHU	T	PAN	0	0	0		5,034	5,034	5,034	1	CRUDE	F	UNSP	UNSP	0	PHILLIPINE WATERS, NORTH S.E.ASIA
204	13	9	89	MORANIA 440 (BARGE)	B	USA	0	0	0		351	351	351	2	GASOLINE	T	40:35N	073:50W	152	EAST RIVER, NY
205	17	9	89	PHILLIPS OKLAHOMA	T	LIB	54,000	0	79		486	486	1,101	1	BRITISH CRUDE	F	53:40N	000:10E	216	NEAR HULL, ENGLAND OUTSIDE HUMBER R
206	4	10	89	PACIFICOS	T	CYP	268,000	0	75		10,136	9,932	10,136	1	LIGHT BASRAH CRUDE	F	33:00S	028:00E	441	30-50 MI OFF EAST LONDON, S. AFRICA
207	15	12	89	CIBRO PHILADELPHIA (BARGE	B	USA	0	0	0		136	136	395	2	NO. 6 FUEL OIL	T	40:40N	074:00W	0	1 MI N. OF VERRAZANNO NARROWS BR.NY
208	19	12	89	KHARK 5	T	IRA	284,632	0	0		64,898	59,837	69,810	1	HEAVY IRANIAN CRUDE	F	34:32N	009:34W	109	100 MI. OFF COAST OF MOROCCO-ATLANT
209	29	12	89	ARAGON	T	SPA	238,959	23,000	76		23,810	23,810	24,932	1	PEMEX MAYA CRUDE	F	33:34N	015:34W	110	N. ATLANTIC NE OF ISLAND OF MADEIRA
210	20	1	90	FRANK H. BROWN	T	CAN	0	0	0		186	159	186	2	GASOLINE	T	56:00N	132:00W	194	ON BURNT ISLAND REEF, WRANGELL, AK
211	24	1	90	MARITIME GARDENIA (MV)	T	LIB	0	0	0		449	449	449	2	BUNKER OIL	F	38:00N	135:00E	131	WAKASA BAY, MAIZURU, HONSHU I.JAPAN
212	25	1	90	CHOTIN 2881& 2183X(BARGE)	B	USA	0	0	0		301	301	333	2	GASOLINE & DIESEL	T	29:00N	090:00W	82	MISS. R., MI. 106, NEW ORLEANS, LA
213	29	1	90	FERNANDO	T	UNS	0	0	0		162	162	162	1	CRUDE OIL	F	14:00N	121:00E	60	MANILA BAY, BATAAN PEN.,PHILIPPINES

Spill Inventory for January 1, 1963 to June 15, 1990

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
214	7	2	90	AMERICAN TRADER	T	USA	82,030	37,269	69		1,287	952	1,293	1	PRUDHOE BAY CRUDE	T	33:40N	118:00W	120	1 1/2 MILES OFF HUNTINGTON BEACH CA
215	18	2	90	STCO–412 (BARGE)	B	USA	0	0	0		272	272	272	2	GASOLINE	T	29:40N	091:20W	82	INTRACOAST WATERWAY–MORGAN CITY, L
216	6	3	90	CIBRO SAVANNAH (BARGE)	B	USA	0	8,151	80		324	324	324	2	NO. 2 HEATING OIL	T	40:35N	074:20W	152	ARTHUR KILL R. NEAR LINDEN, NJ
217	29	3	90	JAMBUR	T	IRQ	0	0	0	UNSP	3,239	1,701	3,239	2	GASOIL	F	41:00N	028:00E	178	BOSPORUS STRAIT NR ISTANBUL, TURKEY
218	5	5	90	THEOGENNITOR	T	CYP	0	0	0	UNSP	188	188	188	1	CRUDE OIL	F	39:00N	009:00W	109	SINES TERM., S. OF LISBON, PORTUGAL
219	12	5	90	ROSEBAY	T	LIB	274,531	0	0	FULL	1,097	1,071	1,097	1	IRANIAN CRUDE	F	50:30N	004:00W	181	24 MI SE OF PLYMOUTH,ENG.–ENG.CHAN.
220	14	5	90	VOLGONEFT 263	T	RUS	0	0	0	UNSP	997	898	997	2	LIGHT WASTE OIL	F	56:00N	016:00E	215	10 MI. SE OF KARLSKRONE, SWEDEN
221	17	5	90	APEX 104	B	USA	0	0	0		687	200	687	2	NAPHTHA	T	31:00N	091:40W	118	ATCHAFALAYA R., SIMMESPORT, LA
222	21	5	90	CAPAHUARI	T	PER	13,811	0	0	PARTIAL	1,490	1,490	1,490	2	KEROSENE	F	12:00S	078:00W	343	1 MI. FROM PORT OF SUPE, PERU
223	7	6	90	NAUTILUS	T	BRI	0	0	0	FULL	842	842	842	2	HEATING OIL/# 6 FUEL	T	40:20N	074:05W	152	KILL VAN KULL, NJ NEAR BAYONNE
224	9	6	90	MEGA BORG	T	NOR	0	0	0		13,854	324	13,854	1	PALANCA ANGOLA CRUD	T	28:33N	094:08W	0	60 MILES OFF GALVESTON, TEXAS

			CASUALTIES				
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
1	OPEN	S	FIRE FLOODING BROKE-IN-2 EXPLOSION FOUNDER	0			LLP-50
2	PIER	P	UNLOADING ERROR	0			
3	RESTR	S	NAVIGATING IN A STRAIT, FIRE	0			
4	RESTR	S	AGROUND ABANDONED SCUTTLED	0			LLP-475
5	RESTR	S	AGROUND	0			
6	RESTR	S		0			
7	RESTR	S	COLLISION W/SHIP	0			
8	RESTR	S	AGROUND STRUCK BOTTOM	0		SLIGHT POLLUTION	
9	HARB	I	CONTACT W/BRIDGE STRUCTR TANK RUPT	0			CO00820, CO01038
10	RESTR	S	AGROUND ON REEF FOUNDER	0			
11	HARB	I	COLLISN STRUCTR HULL RUPT	0			
12	RESTR	S	COLLISN	0			
13	RESTR	S	AGROUND	0			
14	RESTR	S	AGROUND STRUCK REEF	0			
15	RESTR	S	COLLISN STRUCTR HULL RUPT	0			
16	HARB	I	CONTACT W/BRIDGE STRUCT	0			
17	HARB	P	AGROUND STRUCTR HULL RUPT	0			
18	RESTR	S	WEATHER AGROUND	0			LLP-287
19	RESTR	S	FIRE HULL RUPT BROKE-IN-2 FOUNDER ABANDON	3	MINIMAL ENVIRONMENTAL DAMAGE 1,500 GANNETS OILED	SLIGHT POLLUTION	LLP-93
20	RESTR	S	WEATHER COLLISN W/CARGO SHIP CAVALRY	0	IMPACTED EXTENSIVE FISHING AREA	COAST	OSIR 9.15
21	RESTR	S	COLLISN	0			
22	PIER	P	MACHINE HOSE BREAKUP DURING DISCHARGE	0			
23	HARB	P	AGROUND STRUCTR HULL RUPT	0			
24	PIER	P	COLLISN W/ PIER	0			
25	RESTR	S	WEATHER COLLISN TANK RUPTURE	0			
26	HARB	P	AGROUND	0			LLP-470
27	RESTR	S	AGROUND REEF	0			
28	RESTR	S	WEATHER AGROUND STRUCTR BREAKUP	0			LLP-72
29	RESTR	S	AGROUND REEF	0			LLP-163
30	OPEN	S	WAVE STRUCTR FIRE EXPLOSION FOUNDER	6			LLP-372
31	HARB	P	RUPTURE	0			
32	OPEN	S	FIRE EXPLOSION ABANDON LISTING CAPSIZE	0			LLP-366
33	RESTR	S	AGROUND LEAK	0			LLP-410
34	HARB	I	COLLISN STRUCTR HULL RUPTURE	0			
35	RESTR	S	AGROUND	0			
36	PIER	P	UNLOADING EXPLOSION FIRE	0			
37	HARB	P	AGROUND STRUCTR HULL RUPTURE	0			
38	HARB	P	AGROUND	0			
39	HARB	I	AGROUND STRUCTR HULL RUPT	0			
40	HARB	P	NOT SPECIFIED	0			
41	HARB	I	COLLISN STRUCTR TANK RUPTURE	7			CO01182
42	RESTR	S	EXPLOSION HULL RUPTURE BROKE-IN-2 FOUNDER	8			LLP-24
43	RESTR	S	AGROUND	0			
44	RESTR	S	COLLISN	0			
45	RESTR	S	MACHINE VALVE MALFUNCTION	0			
46	HARB	I	MACHINE STEERING AGROUND STRUCTR HULL RUPT	0	450 BIRDS OILED/165 DEAD	MODERATE POLLUTION	LLP-317
47	HARB	I	AGROUND STRUCTR HULL RUPTURE	0			
48	HARB	P	NOT SPECIFIED	0			
49	RESTR	S	UNDETERMINED	0			
50	RESTR	S	AGROUND	0			
51	HARB	I	CONTACT HULL PUNCTURE ON PILING	0			
52	HARB	P	GROUNDING	0	4 OILED BIRDS		
53	RESTR	S	WEATHER COLLISN FIRE	0			
54	HARB	P	AGROUND STRUCTR HULL RUPT	0			
55	PIER	P	UNLOADING EXPLOSION FIRE BROKE-IN-2	6			LLP-366
56	RESTR	S	AGROUND HULL RUPT CRACKED TANKS	0	BEACHES & SEAWALLS OILED, LITTLE ENV. AFFECTED	OIL ON BOLIVAR PENINSULA N. OF GALVESTON, TX	OSIR 8.3,9,12 9.47
57	RESTR	S	COLLISN	0			
58	PIER	P	ERROR AT TERMINAL, MACHINE EQUIPMENT FAILURE	0			
59	RESTR	S	AGROUND	0		SLIGHT POLLUTION	
60	RESTR	S	EXPLOSION FIRE FOUNDER	3			LLP-398
61	HARB	P	AGROUND HULL RUPT	0		SLIGHT POLLUTION	
62	HARB	I	COLLISN AGROUND STRUCTR HULL RUPT	0			
63	PIER	P	LOADING EXPLOSION FIRE AGROUND	9		POLLUTION	LLP-264
64	HARB	P	AGROUND	0			
65	RESTR	S	EXPLOSN FIRE STRUCTR HULL RUPT BREAK-UP	1	1550 BIRDS OILED/1200 DEAD	FARALLON ISLANDS AND BODEGA HARBOR	OSIR 10.10,33 LLP382
66	RESTR	S	FIRE AGROUND	0			LLP-94
67	HARB	I	UNSPECIFIED	0			
68	HARB	I	NOT SPECIFIED	0			
69	RESTR	S	AGROUND	0			
70	RESTR	S	COLLISN W/ VESSEL STRUCTR HULL RUPT	0		SLIGHT POLLUTION	
71	RESTR	S	UNKNOWN	0			

				CASUALTIES			
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
72	RESTR	S	COLLISN	0			
73	HARB	I	COLLISN BTW BARGES STRUCTR HULL RUPTURE	0			
74	RESTR	S	UNSPECIFIED	0			
75	RESTR	S	UNSPECIFIED	0			
76	HARB	I	COLLISN STRUCTR HULL RUPTURE	0			
77	RESTR	S	AGROUND	0			
78	PIER	P	FIRE	6			LLP-383
79	HARB	P	COLLISN	0		OIL COLLECTED ALONG S. BANK OF ATCHAFALAYA RIVER	
80	HARB	P	COLLISN	0			
81	PIER	P	LOADING EXPLOSION FIRE FOUNDER	1			LLP-279
82	RESTR	S	AGROUND	0			
83	RESTR	S	AGROUND	0			
84	PIER	P	CONTACT W/DOCK STRUCTR HULL RUPTURE	0		SLIGHT POLLUTION	
85	RESTR	S	COLLISN W/SHIP FIRE AGROUND	3		FEW TONS OF OIL ON THE COAST OF SICILY & TAORMINA	OSB 4/85 LLP-363
86	RESTR	S	EXPLOSION FIRE LEAK BROKE-IN-2 FOUNDER	0			LLP-172
87	RESTR	S	COLLISION W/SHIP	0			
88	HARB	P	PERSONL error	0			
89	PIER	P	PERSONL TANK OVERFLOW	0			
90	HARB	P	MACHINE CONTACT STRUCTR TANK RUPT	0			
91	PIER	P	LOADING, EXPLOSION FROM MT PETRAGEN ONE, FIRE	13			LLP-85,367(PETRAGENI
92	PIER	P	EXPLOSN FIRE DURING DISCHARGE FOUNDER	35		733 BBLS WASHED ASHORE ON LALINEA, GIBRALTAR	LLP-367
93	RESTR	S	AGROUND	0		SLIGHT POLLUTION	OSB JULY 85
94	RESTR	S	COLLISN	0			
95	RESTR	S	WEATHER LEAK	0			
96	PIER	P	FLOODING/LEAK	0			
97	RESTR	S	UNSPECIFIED	0			
98	RESTR	S	COLLISN STRUCTR	0	SALT MARSHES AFFECTED 500-2000 BIRDS DEAD	733 BBLS ON LAESO ISL. 10KM COAST, SOME BEACHES	OSIR 10.17,33
99	HARB	P	LEAKAGE FOUNDER	0			
100	RESTR	S	UNSPECIFIED	0			
101	RESTR	S	AGROUND	0		SOME BEACH AFFECTED ON ALAND ISLS, FINLAND	
102	PIER	P	DEGASSING EXPLOSION BROKE-IN-2	1			LLP-434
103	HARB	P	AGROUND STRUCTUR HULL RUPTURE	0			
104	HARB	P	AGROUND STRUCTR TANK RUPT	0	35 BIRDS OILED - SOME FISH (CORMORANTS & MUSKRATS)	OIL WASHED ASHORE AT 32 SITES	OSIR 9.16 &39-41,43
105	HARB	P	WEATHER FOUNDER	0		6 MI COASTLINE POLLUTED	L-138
106	HARB	I	COLLISN STRUCTR HULL RUPT	0			
107	RESTR	S	AGROUND	0	200 BIRDS OILED		
108	RESTR	S	COLLISN	0	30 PENGUINS OILED		
109	OPEN	S	COLLISN W/ PAN TANKER MAGNUM	0			
110	RESTR	S	AGROUND STRUCTUR HULL RUPTURE	0			
111	HARB	P	PERSONL MACHINE STRUCTR HULL RUPT	0			
112	HARB	I	COLLISN W/ BRIDGE STRUCTR HULL RUPT	0			
113	HARB	P	WEATHER AGROUND STRUCTR HULL RUPT	0	1490 BIRDS OILED/800 DEAD		
114	PIER	P	LOADING	0	SHELLFISH & EEL FISHING AREAS	60KM COASTLINE	
115	HARB	P	COLLISN STRUCTR	0		93 MI. SHORE & ISLANDS CONTAMINATED	
116	RESTR	S	COLLISN	0			
117	PIER	P	PERSONL? MACHINE? TANK OVERFLOW	0			
118	HARB	P	STRUCT FAILURE AGROUND	0		4-MI STRETCH OF BOATS & MARINA OILED	
119	HARB	P	COLLISION	0			
120	HARB	I	AGROUND STRUCTR HULL RUPT	0			
121	PIER	P	CONTACT W/PIER	0	15 OILED BIRDS	SLIGHT POLLUTION	
122	RESTR	S	AGROUND	0			LLP-495
123	PIER	P	LOADING EXPLOSION FIRE AGROUND	3			LLP-444
124	PIER	P	OFFLOADING ERROR	0		60 SQ. KM AFFECTED	
125	RESTR	S	COLLISION W/ ST BRIGHT DUKE, FIRE	8			LLP-359-360
126	HARB	I	OFFLOADING EXPLOSN FIRE HULL RUPT FOUNDER	0			
127	RESTR	S	FOUNDER	0			
128	OPEN	S	FOUNDER	0		POLLUTION ON NEARBY BEACHES	LLP-305
129	HARB	I	NEGLIGENCE	0			
130	HARB	P	AGROUND STRUCTR HULL RUPT	0	3 BIRDS KILLED	OILED 10 MI. STRETCH BTW. SCHUYLKILL R. &MARCUS H.	
131	HARB	P	COLLISION? AGROUND STRUCTR TANK RUPT	0			
132	RESTR	S	COLLISN	0			
133	OPEN	S	PERSONL IMPROPER WASTE DISPOSAL	0			
134	HARB	I	COLLISN STRUCTR TANK RUPT	0			
135	RESTR	S	COLLISION	0			
136	HARB	P	VALVE FAILURE	0			
137	HARB	P	VALVE FAILURE	0		12 MI. RIVER AFFECTED	
138	RESTR	S	WEATHER AGROUND	0	SEABIRDS IMPACTED	150KM COAST OILED- MOST OIL ASHORE STUCK IN ICE	OSIR 865UM
139	RESTR	S	WEATHER STRUCTR HULL FRACTURE LEAKAGE	0		NO OIL TO SHORE	CA STATE LANDSC 1990
140	RESTR	S	STRUCTR HULL RUPT	0			
141	RESTR	S	WEATHER STRUCTR EQUIP FAILURE IMP. SECURING	0	HEAVIEST OILING AT MAKAPU, 15 BIRDS KILLED	30 MI COAST CLOSED BEACHES (MAGNUM PI SET)	
142	RESTR	S	WEATHER COLLISION FIRE STRUCTR LISTING	0		MINIMAL POLLUTION	CA STATE LANDS C1990

			CASUALTIES				
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
143	RESTR	S	WEATHER AGROUND	0		SLIGHT POLLUTION	
144	RESTR	S	WEATHER AGROUND	0	NEAR DODERSKAR BIRD SANCTUARIES AND FISHERIES	SLICK 600MX250M, OIL IN ICE	CA STATE LANDS C1990
145	HARB	I	AGROUND RUPT	0	NO PERSISTENT POLLUTION	NONE	
146	HARB	I	WEATHER HULL RUPTURE	0			
147	RESTR	S	TANK LEAK	0			
148	PIER	P	ANCHORED COLLISN W/SHIP STRUCTR	0			
149	PIER	P	UNLOADING AT PORT, TERMINAL ERROR	0			
150	RESTR	S	WEATHER COLLISION W/HEL(CV) FIRE	0	OSIR 875UM REPORTS 2 SPILLS, 5/30 & 6/12	OSIR X.23 INDS. SAME SPILL, 5/30, REPORTED 6/12	CA STATE LANDS C1990
151	HARB	P	STEERING COLLISION (VITORIA-EXPLOSION FIRE)	0			LLP-504(VICTORIA)
152	RESTR	S	AGROUND ROCK STRUCTR HULL	0	NO FISH KILLS, 35K LBS FISH CONTAMINATED	TAR BALLS ON COASTLINE & TIDAL FLATS	CA STATE LANDS C1990
153	RESTR	S	STRUCTRL LEAK ABANDON FOUNDER	0		EXTENSIVE POLLUTION	LLP-146
154	RESTR	S	AGROUND	0		EXTENSIVE POLLUTION	
155	PIER	P	CONTACT W/ DOCK	0		SLIGHT POLLUTION	
156	RESTR	S	AGROUND REEF HULL RUPT	0		POLLUTED SINGAPORE STRAIT 3 MI S OF RAFFLES LIGHTH	
157	RESTR	S	WEATHER ELECTRICAL FIRE LISTING AGROUND	0		30 KM COAST	LLP-11
158	PIER	P	TANK CLEANING	0	LARGE IMPACT ON BIRDS	SHORELINE CONTAMINATION	
159	OPEN	S	WEATHER STRUCTURE TANK RUPTURE LEAKAGE	0			CO 08587 + 100K BBL
160	HARB	P	WEATHER WINDS NAVIGATING, AGROUND	0			CA STATE LANDS C1990
161	RESTR	S	COLLISION W/ FERRY DONA PAZ EXPLOSION FIRE	4386			LLP-132,497
162	HARB	I	COLLISION IMPROPERLY SECURED HULL RUPTURE	0			
163	PIER	P	COLLISION W/BARGES WHILE DOCKED RUPT TANK	0			CA STATE LANDS C1990
164	RESTR	S	AGROUND STRUCTUR HULL RUPTURE	0			
165	HARB	P	CAPSIZE FOUNDER	0	OSIR 865UM HAS ADDITIONAL 3/2/88 ENTRY--APPEARS TO	CORRELATE WITH REFLOATING/SALVAGE OF BARGE.	
166	RESTR	S	NAVIGATING STRUCTURAL DAMAGE LEAKAGE	0			
167	RESTR	S	HULL FAILURE	0			
168	OPEN	S	EXPLOSION FIRE SPLIT FOUNDER	29			CA STATE LANDS C1990
169	HARB	I	TANK RUPTURE	0			
170	HARB	P	AGROUND	0		EXTENSIVE POLLUTION IN PORT	
171	PIER	P	RAMMED PIER HULL RUPTURED TANK	0	HARBOR CLOSED UNTIL 07/16/88	SLIGHT POLLUTION	CA STATE LANDS C1990
172	RESTR	S	AGROUND HULL RUPTURE	0			
173	RESTR	S	STRUCTUR BREAKUP AGROUND	0		SLIGHT POLLUTION	
174	HARB	P	AGROUND	0			
175	HARB	P	AGROUND STRUCT HULL RUPTURE	0	MINIMAL	PROBABLY MOST SUNK	CA STATE LANDS C1990
176	RESTR	S	WEATHER MANIFOLD RUPTURE COVER LOST	0			
177	HARB	P	COLLISION	0		EXTENSIVE POLLUTION OF SINGAPORE STRAIT	
178	OPEN	S	WEATHER STRUC FAILURE FIRE FOUNDER	27			CA STATE LANDS C1990
179	RESTR	S	WEATHER LEAK LISTING	0			
180	RESTR	S	COLLISION W/TUG BOAT DURING TOWING	0	8,000 OILED BIRDS OTTERS OK	100 MI. VANCOUVER I. OIL STAYED ON SAND ISL. BEACH	R.FARVE MMS,PACIFIC
181	RESTR	S	WEATHER CAPSIZE FOUNDER	0			
182	PIER	P	STRUCT CRACK IN HULL	0			ANCHORAGE DAILY NEWS
183	RESTR	S	WEATHER STRUCTUR	0			
184	PIER	P	COLLISION W/ SHIP	0			
185	RESTR	S	AGROUND FLOOD FOUNDER	0	BIRD KILLS, DISRUPTED NSF RESEARCH	SLIGHT POLLUTION	
186	PIER	P	WEATHER CONTACT W/ DOCK STRUCTURAL	27			
187	RESTR	S	AGROUND ON REEF	0			
188	HARB	I	WEATHER COLLISION 2 TANK RUPTURES, 1 HULLRUPT	0			
189	RESTR	S	UNDER TOW LEAK	0			
190	RESTR	S	AGROUND	0	FWS: MORTAL 36,471 BIRDS, 1,016 OTTERS, 144 EAGLES	OILED 1,000+ SQUARE MILES, 350+ MI. SHORELINE	W.P.3/25-30,NRT RPT.
191	HARB	I	CONTACT WITH STONE EMBANKMENT	0			
192	PIER	P	CONTACT DAMAGE TO BUNKER TANKS WHILE AT BERTH	0			CA STATE LANDS C1990
193	RESTR	S	AGROUND	0			
194	HARB	I	CONTACT WITH MARKER LIGHT	0			
195	RESTR	S	AGROUND	0			
196	HARB	P	NAVIGATIONAL ERROR AGROUND	0	FISH EGGS AND LARVAE KILLS	OILED BEACHES	CA STATE LANDS C1990
197	HARB	P	COLLISION WITH PANAMANIAN TANKER RACHEL B	0		SLIGHT POLLUTION	
198	HARB	P	HUMAN ERROR DROPPED ANCHOR WHILE UNDERWAY	0	120 OILED BIRDS (CANADIAN GEESE) 5 BIRDS KILLED	OIL ON 21 MILES OF SHORELINE	OSIR XIII.16,19
199	PIER	P	LOADING EXPLOSION SCUTTLED	0			
200	OPEN	S	COLLISION W/ SHIP	0			
201	PIER	P	COLLISION WITH DOCK	0			
202	PIER	I	UNLOADING TANK OVERFLOW	0		ASPHALT INTO HARBOR	
203	RESTR	S	NAVIGATING, FLOODED OR LEAKED, FOUNDER	16			
204	HARB	I	AGROUND	0			
205	RESTR	S	COLLISION WITH MALTESE TANKER FIONA	0			WASH. POST 9/17/89
206	RESTR	S	HIGH SEAS, STRUCTURAL DAMAGE	0			
207	HARB	P	MOVEMENT OF TUGBOAT WHILE BARGE ANCHORED	0			
208	OPEN	S	WEATHER COLLISION HULL RUPTURE FIRE	0			OSIR XIII.4,5,6
209	OPEN	S	HEAVY SEAS CAUSED TANK PLATING BREAK	0		5 COVES WITH 15 KILOMETERS OF ROCKY SHORE OILED	
210	HARB	P	AGROUND ON REEF RUPTURED STORAGE TANK	0			
211	RESTR	S	WEATHER AGROUND FOUNDER	0	SERIOUS DAMAGE TO SEAWEED FARM, FISHERY & WILDLIFE		
212	HARB	P	COLLISION BETWEEN 2 SETS OF BARGES	0			
213	PIER	P	LEAK WHILE LOADING	0			

Spill Inventory for January 1, 1983 to June 15, 1990

				CASUALTIES			
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
214	HARB	P	HULL RUPTURE ON ANCHOR AT UNLOADING BUNKER	0	547 OILED BIRDS SURVIVED, 513 DIED DUCKS/BRWN PELS	OILED 15+ MI. SHORE BTW. NEWPORT & SEAL BEACHES	UP & API 2/8/90
215	HARB	I	COLLISION FIRE	0			
216	HARB	P	EXPLOSION	0	1 OILED SEAGULL		
217	RESTR	S	COLLISION	0		200 KM SHORELINE CONTAMINATED NEAR ISTANBUL	
218	PIER	P	UNLOADING PERSONNEL ERROR	0		BEACHES THREATENED	
219	RESTR	S	COLLISION W/DIONNE MARIE STRUCT	0	OYSTER BEDS, COMORANTS, KITTYHAWKS, GULLS	14 MI. BEACHES IN BIOBURY BAY CONTAMINATED	
220	RESTR	S	WEATHER COLLISION W/BETTY	0	FEW SEABIRDS OIL	MINIMAL	
221	HARB	I	UNDER TOW, CONTACT W/BRIDGE	0			
222	RESTR	S	PILOT ERROR, AGROUND	0	100'S DEAD BIRDS AND FISH	BEACHES OILED	
223	HARB	P	AGROUND WHILE DOCKING	0	2 BIRDS DEAD	OIL ON STATEN ISLAND AND NEW JERSEY BEACHES	ASSOC. PRESS., WP
224	OPEN	S	OFFLOADING FIRE EXPLOSIONS	0			USCORRT, NOAAHOTLINE

	REFERENCE SOURCE					
	OSIR	OSB	CGUARD	IFP	GOLOB	COMMENTS
1	6.3			8301		SANK AT 22:43N, 63:00E
2				8303		
3				8304		
4	6.4,5,6			8306		
5				8308		
6	83SUM					
7				83-12		
8	83SUM			8319		
9	6.13,14		755	8324		
10	83SUM			8327		
11	83SUM		1332			
12	83SUM					
13				8328		
14	83SUM			8330		
15			499			
16	83SUM			8333		
17	6.26		446			
18				8337		
19	83SUM 8.18			8339		LARGEST SPILL IN SOUTH AFRICAN HISTORY
20	6.33 9.13 10.13,33					
21	83SUM					
22	83SUM					
23	83SUM		1444	8343		IFP, IR HAD MATTHEW – USCG HAD CHRISTINA
24	83SUM			8344		
25	83SUM			8345		
26	83SUM			8347		
27	83SUM			8352		
28	83SUM					
29	6.48			8355		ZHONGSHA REEF OFF PORT OF QINGDAO, CHINA
30	6.48			8356		
31	6.49					
32	6.49			8360		
33				8361		
34	83SUM		9395			IR HAD 2,500
35				8362		
36				8402		
37	7.5 9.47		271	8403		
38	7.5 8.31 9.47					
39			1185			
40			142			
41	84SUM		409	8407		CO – 4,000 BBL CRUDE, 9,800 BBL MIN. SEAL; OSIR – AMERICAN EAGLE
42	7.9, 8.51		409	8407		
43	7.9 9.47					
44	9.47					COLLISION WITH TANKER NOVA PROGRESS
45	9.47					
46	83SUM 7.42 8.7 9.47		700	8414		
47	9.47		1153			
48			874			
49	9.47		6590			
50	9.47					
51	7.27 9.47		1043			
52	9.47					
53	9.47			8424		
54	7.28,29 9.47		197			
55				8425		IFP DATE 7/6/84, REPAIRMAN'S BLOWTORCH SET OFF EXPLOSION
56	7.30–33,35,36,38			8428		
57	9.47					
58	9.47			8431		IFP HAD LIB
59	9.47			8433		
60				8436		
61	9.47			8437		
62	7.43 9.47		796			SPILLED INTO ST. LOUIS, MISSOURI HARBOR
63				8438		
64	7.44 9.47			8440		OIL DISSIPATED BY STORMS AND SEAS
65	7.44,45,9.5, 9.47		272	8441		BROKE UP NOV. 3, STERN SUNK 26 MILES OFFSHORE NEAR FARALLONS
66				8442		
67	7.48					
68			992			
69				8444		
70	9.47			8445		
71	9.47		9752			

	REFERENCE SOURCE					
	OSIR	OSB	CGUARD	IFP	GOLOB	COMMENTS
72	9.47					
73	9.47					
74	9.47					
75	9.47					
76	9.47		208			
77				8505		
78				8506		
79	8.10 9.47					
80	8.10 9.47					
81				8508		
82				8510		
83	9.47			8511		
84	9.47			8512		
85	8.28 9.47 10.17,33	4.4		8513		COLLISION WITH SPANISH TANKER CASTILLO DE MONTEARAGON
86				8516		CLEANING CARGO TANKS, 2 CREWMEN MISSING
87				8517		
88	8.48 9.47					
89	9.47 8.19		496			IR HAD 5/8/85
90	9.47		574			
91				8520		
92	8.21,22 9.47			8521		ADJACENT TANKER CAMPONAVIA CAUGHT FIRE AND SANK
93	9.47	4.7		8524		
94	9.47			8526		
95				8527		
96				8528		
97			6181			
98	8.31,32 9.47	4.8				
99	8.37 85SUM	4.10,11		8532		6,000 BBL RECOVERED
100			506			
101	9.47 10.17,33	4.10				
102				8536		
103			921			
104	9.47, 10.35, 11.1	4.10	2380	8539		CO HAD AMERSHAM RATHER THAN GRAND EAGLE
105	8.51 9.47	4.12,5.1				20,000 BBL SANK WITH BARGE, LARGEST SPILL EVER IN AREA
106	8.50 9.47		1798			
107	9.47	5.1				
108	85SUM	5.1		8542		IFP HAD FUEL OIL. OSIR 85SUM PROCESSED OIL. OSB LIGHT OIL
109	9.1,9.2,9.47	5.1,2		8543		
110	8.51		3624			
111			2306			
112	8.50 9.47	5.1	2284			ONE OF 9 BARGES UNDER TOW BY MV DIXIE POWER
113	8.51,9.1,2,6,16	5.1,2,3	203	8545		
114	9.4,9.47 10.17, 10.33	5.2				
115	10.12, 10.33	5.2				
116	86SUM	5.2		8605		
117	86SUM		889			
118	86SUM	5.3				MOST OIL RECOVERED
119	86SUM					
120	86SUM		1738			3333 BBL RECOVERED
121	9.14 86SUM	5.4	2114	8609		
122	86SUM	5.6		8615		OSIR 86SUM: BUNKER C; LLP, OSB & IFP: CRUDE.
123				8617		
124	86SUM	5.7		8619		
125				8620		
126	9.34, 10.31, 86SUM		141	8727		IFP & USCG HAVE 7/31/87, WRITE-UP IN 1986 OSIR WEEKLY
127		5.8				
128	86SUM	5.8,9		8622		3,500 BBL ESCAPED, 10,000 TRAPPED INSIDE. OSIR 86SUM: 9/5/86
129	86SUM					
130	9.38,9.44 86SUM	5.9	1901	8627		5,167 BBL RECOVERED
131	9.39 86SUM	5.9	7329			CAPE COD CANAL
132	86SUM	5.10		8630		COLLIDED WITH A CONTAINER VESSEL
133	9.44, 86SUM		8141	8631		CO & OSIR 86SUM HAVE CRUDE. IFP HAS BUNKER
134	86SUM			8330		
135	86SUM					CODED 'AT SEA' NO INFO AS TO WHETHER PORT, INLAND OR AT SEA.
136	86SUM			8628		267 BBL RECOVERED
137	86SUM	5.12	9500	8636		IFP HAS CRUDE, OTHER SOURCES REFINED
138	10.4, 12.33, 11.17	5.12, 6.2		8696	11.8	157 BBL RECOVERED
139	10.4, 87SUM	6.1	330	8701		OIL SPILLED EN ROUTE BETWEEN VALDEZ & PUERTO ARMUELLES
140			330			
141	10.5,6, 87SUM		506			
142	10.5 87SUM			8706		COLLISON W/THEO THYSSEN

	REFERENCE SOURCE					COMMENTS
	OSIR	OSB	COGUARD	IFP	GOLOB	
143				8707		
144	10.7,8, 11.14, 87SUM	6.2,3,5		8709	II.6	43 BBL RECOVERED
145	10.9 87SUM	6.3				
146	87SUM		1081			83 BBL RECOVERED
147	87SUM					PLACED 'AT SEA', NO INFO TO DETERMINE INLAND, PORT OR AT SEA
148		6.5		8717		
149				8718		
150	X.23, 87SUM					PANAMANIAN? OSIR X.23 SAYS ONLY CARGO VES. HEL LOST OIL
151	X.25, 87SUM					X.25 OSIR ACCT. SAYS NO LOSS FROM FUYOH MARU, VITORIA EMPTY
152	10.28,32,87SUM, 11.18	6.7,8	4651	8723		NEAR SALMON SEASON, SIG. FISHING AREA CLOSED. 357 BBL RECOV.
153		6.7		8722		OSB HAD 7/2/87. NOT CLEAR WHETHER SUNK OR NOT
154	87SUM			8724		
155				8725		
156	11.14, 87SUM	6.7		8726		OSB HAD LIBYAN
157	11.14, 87SUM	6.8,9		8730		OSIR 87SUM 8/23/87, LLP 8/26/87
158	87SUM					848 BBL RECOVERED
159	10.41 87SUM	6.9	7257	8733	CA STATE LC 1990	2 LARGEST U.S. SPILLS IN 1987, 13 CASUALTIES SINCE BUILT '77
160	87SUM	6.11		8735		
161	10.50 87SUM	CA SLC 1990		8745		11 VECTOR CREWMEN KILLED. WORLDS WORST MARITIME DISASTER
162	88SUM		29			
163	11.5 88SUM					
164	11.6 88SUM		436	8802		
165	11.6,7,16 88SUM		1511			JUST SANK. ADDITIONAL 1690 BBL IN 1987. 29 BBL RECOVERED.
166	88SUM			8803		IFP HAS CRUDE. OSIR 88SUM HAD FUEL
167	88SUM					
168	11.18 88SUM			8813		
169	88SUM					
170	88SUM			8817		
171	11.31, 88SUM		4534	8819		11,333 BBL RECOVERED
172	88SUM		5576			0–3 MILES FROM SHORE
173	11.36, 88SUM			8820		
174	88SUM			8821		
175	11.37, 88SUM		5592	8822		
176	11.39, 88SUM		6300			
177	88SUM			8823		
178	11.47, 88SUM			8827		
179	88SUM			8828		
180	12.1,2,4,5,44,88SUM		186	8830		TAR BALLS TUG WAS ATTEMPTING TO REPLACE A BROKEN TOW LINE
181	12.4			8831		
182			566			LARGEST SPILL IN VALDEZ PORT SINCE 1978, EASILY CONTAINED
183				8902		
184				8901		
185	12.7,13,19,46			8903		AT PALMER STATION, NSF RESEARCH BASE
186				8904		
187				8905		
188			1180			CO LAT 43:31N DIDN'T MAKE SENSE
189				8906		
190	12.14–43,46–48	OSIR XIII.12–13	2004	8908	I.2,II.2,CSLC90	NAT. RESPONSE TEAM RPT., MAY 1989. WINTER PLAN OSIR 12.35
191	12.16					
192	12.17					
193	12.19,25			8911		
194	12.20					
195	12.28			8915		
196	12.27–29,32,34–36			8916	II.1,II.2,7	URI & WOODS HOLE HAVE BASELINE, WILL STUDY EFFECTS
197	12.27,28,29,32			8917	I.1	
198	XII.27,28,29,32,34				I.1,II.2	CALIF. STATE LANDS COMMISSION 1990
199				8918		
200				8919		
201				8920		
202					II.7	
203				8921		
204	12.39					
205	12.39			8923		
206	12.42(HOT),43,45			8924		LOST HULL PLATING, VERY ROUGH SEAS OIL DISPERSED QUICKLY
207	XII.52,53				I.3	
208	XII.52,53,XIII.1,3,				II.2,3,4	COLLISION W/METAL TOWER,EN ROUTE FROM IRAN TO N. EUROPE
209	XIII.1,2,3,4,5,6				II.1,2,3,4	
210	XIII.4				II.3	FROM VANCOUVER, DESTINATION SKAGWAY, AK
211	XIII.4,7				II.4	
212	III.3				II.3	
213	XII.4,5					

	REFERENCE SOURCE					
	OSIR	CSS	COUARD	IFP	GOLOB	COMMENTS
214	XIII.6,7,8,9,10,11				II.4,5	AT OFFSHORE UNLOADING BUNKER GOLDEN W MOORING MARINE TERMINAL
215					II.5	COLLIDED WITH MO-774 BARGE
216	XIII.10,11					
217	XIII.13,14				II.9	COLLISION WITH DA TONG SHAN CHINESE BULKCARRIER
218	13.19					
219	XIII.20,21				II.11	
220	XIII.20,21				II.11	
221	XIII.21				II.11	
222	XIII.22					
223	XIII.23SUP					
224						

APPENDIX B

MMS TANKER SPILLS
IN ORDER OF SPILL SIZE

7

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
AMOCO CADIZ	LIB	OFF PORTSALL, BRITTANY NWEST FRANCE	220279	78	MACHINE OTHER AGROUND
CASTILLO DE BELLVER	SPA	75 KM S. AFRICA, NW CAPE TOWN	189483	83	FIRE HULL RUPT BROKE-IN-2 FOUNDER ABANDON
ODYSSEY	LIB	730 MI. NE OF ST.JOHNS,NEWFOUNDLAND	139619	88	WEATHER STRUC FAILURE FIRE FOUNDER
ATLANTIC EMPRESS	GRE	30 KM NE TRINIDAD-TOBAGO	138335	79	WEATHER COLLISN LEAKAGE FIRE
ATLANTIC EMPRESS	GRE	450KM EAST OF BARBADOS	134383	79	FOUNDER
IRENES SERENADE	GRE	NAVARINO BAY, OFF PILOS, GREECE	118562	80	EXPLOSN FIRE FOUNDER
URQUIOLA	SPA	LA CORUNA, SPAIN	100725	76	AGROUND FIRE EXPLOSN ABANDON
INDEPENDENTA	RUM	BOSPORUS STRAIT, ISTANBUL, TURKEY	93576	79	PERSONNEL ERROR COLLISN EXPLOSN FIRE AGROUND
HAWAIIAN PATRIOT	LIB	320 MI W OF HAWAII (KAUAI I.)	84811	77	WEATHER HULL RUPTLEAKAGE EXPLOSN FIRE FOUNDER
JAKOB MAERSK	DAN	PORT LEIXOES, N. PORTUGAL	78576	75	WEATHER AGROUND EXPLOSN FIRE BROKE-IN-2
NOVA (NOYA?)	LIB	140KM S OF KHARG IS ARAB. GULF	70952	85	COLLISN W/ PAN TANKER MAGNUM
KHARK 5	IRA	100 MI. OFF COAST OF MOROCCO-ATLANT	64890	89	WEATHER COLLISION HULL RUPTURE FIRE
ASSIMI	GRE	RAS AL HADD, 50 MI. FROM MUSCAT	51566	83	FIRE FLOODING BROKE-IN-2 EXPLOSION FOUNDER
YUYO MARU 10	JAP	TOKYO BAY, JAPAN	49864	74	COLLISION W/SHIP FIRE EXPLOSION SCUTTLED
ANDROS PATRIA	GRE	BAY OF BISCAY,CAPE FINISTERRE,SPAIN	47210	78	WEATHER HULL RUPT LEAKAGE EXPLOSN FIRE
METULA	HOL	SATTELITE BANK,MAGELLAN STR., CHILE	45165	74	PERS ERR AGROUND HULL RUPT WEATHER ABANDON
BRITISH AMBASSADOR	BRI	180 MI. W. OF IWO JIMA I, PACIFIC	44898	75	NAVIGATING LEAK TOW WEATHER FOUNDER
GINO	LIB	40 MI. OFF COAST OF BRITTANY,FRANCE	41886	79	WEATHER, COLLISION W/ TEAM CASTOR, FOUNDER
TADOTSU	LIB	GULF OF OMAN	39864	78	NAVIGATING NO CAUSE CITED
PERICLES G. C.	GRE	ARABIAN GULF, 200 MI ENE DOHA QATAR	38912	83	FIRE EXPLOSION ABANDON LISTING CAPSIZE
JUAN A. LAVALLEJA	URU	OFF ARZEW, ALGERIA	35504	80	WEATHER CONTACT AGROUND
BRAZILIAN MARINA	LIB	SAO SEBASTIAO, BRAZIL	35310	78	AGROUND LEAKAGE
BURMAH AGATE	LIB	4 MI. FR ENTR. GALVESTON BAY, TEXAS	34661	79	COLLISN W/ MIMOSA FIRE EXPLOSN AGROUND
ATHENIAN VENTURE	CYP	350-400 MI. SE OF CAPE RACE, NEWFO.	34344	88	EXPLOSION FIRE SPLIT FOUNDER
IRENES CHALLENGE	LIB	200 MI (320 KM SE) OF MIDWAY ISLAND	33907	77	STRUCTR BROKE-IN-2 FOUNDER
SAINT PETER	LIB	30 MI W OF PUNTA MANGLARES,COLOMBIA	33907	76	FIRE EXPLOSN ABANDON
EXXON VALDEZ	USA	BLIGH REEF, P. WILLIAM S. VALDEZ AK	32721	89	AGROUND
ELLEN CONWAY	LIB	MED. SEA, OUTER HARB ARZEW, ALGERIA	29932	76	NAVIGATING, UNKNOWN
IOANNIS ANGELICOUSSIS	GRE	CABINDA GULF OIL, MALONGO, ANGOLA	29932	79	MACHINE AGROUND
JAPAN GALATHUS	JAP	PERSIAN GULF	29932	78	EXPLOSN FIRE TOWED ABANDON FOUNDER
SCORPIO	GRE	GULF OF CAMPECHE?,11 MI FR PORT,MEX	29932	76	NAVIGATING, AGROUND HULL RUPT
CRETAN STAR	CYP	450 MI OFF BOMBAY, INDIA	29918	76	WEATHER LEAKAGE STRUCTR FOUNDER
GOLDEN CRANE	LIB	MID-NORTHERN INDIAN OCEAN	28921	77	HIGH SEAS EXPLOSION
GRAND ZENITH	PAN	ATLANTIC O., MASSACHUSETTS	28921	76	HIGH SEAS STRUCTURAL DAMAGE
HARALABOS	LIB	RAS GHARIB, GULF OF SUEZ	27366	82	LOADING EXPLOSION FIRE AGROUND
BETELGEUSE	FRE	BANTRY BAY, IRELAND	26864	79	UNDLOADING FIRE EXPLOSN SPLIT-IN-2 FOUNDER
BORAG	LIB	REEF 4 KM OFF TAIWAN (NR. YEH-LIU)	26112	77	AGROUND LEAKAGE WEATHER FOUNDER
AL SABBIYAH	KUW	40 MILES OFF JAPAN	24898	77	WEATHER LEAKAGE STRUCTR
CARIBBEAN SEA	PAN	S. OF EL SALVADOR CENTRAL AMER.	24717	77	WEATHER MACHINE LEAKAGE FOUNDER
ARGO MERCHANT	LIB	45 KM SE OF NANTUCKET, MA	24295	76	PERSONL AGROUND
ARAGON	SPA	N. ATLANTIC NE OF ISLAND OF MADEIRA	23810	89	HEAVY SEAS CAUSED TANK PLATING BREAK
VENOIL	LIB	32 KM OFF SOUTH AFRICA	23216	77	WEATHER MACHINE COLLISN W/VENPET FIRE AGROUND
TITIPOR	GRE	TOMANAUS ROADS, BRAZIL	21497	79	CONTACT EXPLOSN FIRE
CAVO CAMBANOS	GRE	TARRAGONA ROADS, OFF CORSICA	20269	81	ENGINE ROOM EXPLOSION FIRE SCUTTLED
AMINONA	GRE	ATLANTIC O., BANCO DO MEIO, BRAZIL	19946	78	AGROUND
MASTER STATHIOS	GRE	50 MI. DURBAN, S. AFRICAN INDIAN O	19946	75	FIRE
IKUYO MARU	JAP	PERSIAN GULF	19864	78	NAVIGATING
THEODOROS V	GRE	MID-ATL., 400M N OF DAKAR, SENEGAL	19864	74	EXPLOSION STRUCTURAL DAMAGE
URSS 1	RUS	RIVER NEAR BLACK SEA, BOSPHORUS	19864	77	HIGH SEAS, EXPLOSION FIRE FOUNDER
ZAVYETY.ILYICHA	RUS	INDIAN OCEAN	19864	80	NAVIGATING, EXPLOSION
SPARTAN LADY	LIB	12-200 MI. OFF NEW JERSEY	19436	75	WEATHER STRUCTR HULL RUPT BROKE-IN-2 SCUTTLED
NANYANG	SOM	S. CHINA SEA, 90 MI E OF HONG KONG	17655	76	COLLISN W/STRAAT ALGOA FOUNDER
PNOC BASILAN	PHI	S CHINA SEA OFF AGOO, PHILLIPINES	17007	83	WAVE STRUCTR FIRE EXPLOSION FOUNDER
SALEM (DELIBERATELY SUNK)	LIB	ATLANTIC O, S OF GAMBIA, W. AFRICA	15918	80	FRAUD/MUTINY? FIRE EXPLOSION ABANDON FOUNDER
AL DAMMAM	ARA	MEDITERRANEAN,AGIOI THEODOROI,GREE	14966	76	NAVIGATING, FIRE
CHERRY VINSTRA	SIN	ARABIAN SEA, GULF OF OMAN	14966	74	NAVIGATING, EXPLOSION AND FIRE
KURDISTAN	BRI	CABOT STRAIT, N. SCOTIA,CANADA	14966	79	CONTACT ICE RAMMING SCUTTLED
GUNVOR MAERSK	DEN	AMAZON R., MANAUS ROADS, BRAZIL	14959	79	WEATHER FIRE AGROUND LEAKAGE
LSCO PETROCHEM	PHI	GULF OF MEXICO, LOUISIANA	14959	76	AGROUND SUBMERGED OBJECT, EXPLOSION, FIRE
TARIK IBN ZIYAD	IRQ	RIO DE JANIERO, BRAZIL	14959	75	AGROUND
MESSINIAKI FRONTIS	LIB	2 KM OFF CRETE KALOI LIMENES	14164	79	AGROUND
THORSHAMMER	UNS	KUWAIT	14099	75	UNSPECIFIED
GLOBE ASIMI	GIB	BALTIC PORT,KLAIPEDA,LITHUANIA,USSR	14023	81	WEATHER AGROUND BROKE IN HALF
AEGEAN CAPTAIN	LIB	30 KM NE TRINIDAD-TOBAGO	13962	79	WEATHER COLLISN LEAKAGE FIRE AGROUND
MEGA BORG	NOR	60 MILES OFF GALVESTON, TEXAS	13854	90	OFFLOADING FIRE EXPLOSIONS
PRINCESS ANNE-MARIE	GRE	BARROW ISLAND, AUSTRALIA	13526	75	WEATHER
TANIO	PAN	60 KM OFF BRITTANY, FRANCE	13463	80	WEATHER RUPTURE EXPLOS STRUCTR FOUNDER
KANCHENJUNGA	IND	JEDDAH, SAUDI ARABI 6 MI. FROM PORT	12634	89	AGROUND
FUYOH MARU/VITORIA	JAP	SEINE R., NR LE HAVRE, FRANCE	11004	67	STEERING COLLISION (VITORIA-EXPLOSION FIRE)
SIMONBURN	BRI	65 KM NE OF SYDNEY, NOVA SCO.	10883	79	CONTACT WEATHER
CENTURY DAWN	PAN	PORT, SINGAPORE WATERS	10191	88	COLLISION
PACIFICOS	CYP	30-50 MI OFF EAST LONDON, S. AFRICA	10136	89	HIGH SEAS, STRUCTURAL DAMAGE
AVILES	LIB	280 MI.NW COCHIN,ARABIAN SEA, INDIA	10000	79	WEATHER EXPLOSN FIRE CAPSIZE FOUNDER
VERA BERLINGIERI	ITA	18 MI (30 KM) OFF FIUMICINO, ITALY	10032	79	WEATHER COLLISN W/SHIP FIRE ABANDON FOUNDER
ELEFTHERIA	GRE	ATLANTIC O.-SIERRA LEONE, W. AFRICA	9973	74	COLLISION W/ SHIP
KOSMAS M	GRE	AKBAS NR.CANAKKALE,DARDANELLES,TUR	9973	78	LOADING EXPLOSION FIRE AGROUND
LAJPAT RAI	IND	BUTCHER I. OIL TERM., BOMBAY, INDIA	9973	84	FIRE EXPLOSION
MARA	VEN	CARIBBEAN,8 MI CURACAO, NETHERLANDS	9973	78	LEAK OR FLOODING
OSWEGO TARMAC	PAN	CARIBBEAN, NETHERLANDS ANTILLES	9973	77	UNLOADING EXPLOSION LEAK/FLOODING
TROJAN	USA	PACIFIC O.?/CHINA SEA?-PHILLIPINES	9973	74	EXPLOSION FIRE FOUNDER
MATSUSHIMA MARU NO.3	JAP	30 MI. SSE OF MUROTO MISAKI, JAPAN	9932	77	EXPLOSN FIRE ABANDON
OLYMPIC ALLIANCE	LIB	ENGLISH CHANNEL, UK	9932	75	COLLISN CONTACT

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
ALVENUS	BRI	18 KILOMETERS SOUTH OF CAMERON, LA	9041	84	AGROUND HULL RUPT CRACKED TANKS
AL-RAWDATAIN	KUW	GENOA, ITALY	8976	77	MACHINE
FORTUNE	LIB	88 KM NE OF SINGAPORE	8846	79	COLLISN
SOUTHERN CROSS	BAH	MEDITERRANEAN, ALGERIAN PORT SKIKDA	7978	86	LOADING EXPLOSION FIRE AGROUND
DERBYSHIRE	BRI	800 KM ESE OKINAWA, JAPAN	7146	80	CAPSIZE FOUNDER
SHOWA MARU	JAP	STRAIT OF MALACCA	6981	75	AGROUND LEAKAGE
LIMA	BRI	PORT, S.W. AFRICA, NIGERIA	6939	78	UNLOADING
BOHLEN	DDR	55 KM OFF BREST, FRANCE	6807	76	WEATHER AGROUND FOUNDER
SEA SPIRIT	UNS	LOS ANGELES HARBOR, CA	6807	74	UNSPECIFIED
(BARGE)	UNS	MI 116 MISSISSIPPI RIVER	6320	74	UNSPECIFIED
CABO TAMAR	CHI	SAN VICENTE BAY, CHILE	6179	78	AGROUND, SCUTTLED 100 MI. OFFSHORE
SIVAND	IRA	IMMINGHAM, ENGLAND	6155	83	COLLISN W/ PIER
SEA SPRAY	SWE	NORTH SOUTHEAST ASIA	5986	74	NAVIGATING, AGROUND
CYS DIGNITY	LIB	OFF ISLA DE MARGARITA, VENEZUELA	5928	79	AGROUND LEAKAGE
EPIC COLOCOTRONIS	GRE	CARRIBEAN, 60 MI. NW OF PUERTO RICO	5714	75	NAVIGATING, HULL CRACKS, FIRE
MASTER MICHAEL	CYP	CARIBBEAN SEA BTW HAITI-VENEZ.	5695	79	WEATHER EXPLOSION FIRE FOUNDER
GOLDEN ACE	KOR	S. CHINA SEA NEAR BORNEO	5485	81	LEAK FOUNDER
PUPPY P	MAL	MID-N. INDIAN OCEAN, INDIA	5485	89	COLLISION W/ SHIP
FORTUNE	LIB	W OF DUBAI, UTD. ARAB EMIRATES	5442	80	AGROUND
BRAZILIAN FAITH	LIB	STRAIT OF MALACCA	5296	76	COLLISN
DIEGO SILANG	PHI	STRAIT OF MALACCA, MALAYSIA	5296	76	COLLISN
ESSO GARDEN STATE	LIB	PORT OR TERMINAL, BRAZIL	5034	74	UNLOADING OVERFILLING ERROR
MARAO	POR	PORTUGESE ATLANTIC	5034	89	EXPLOSN FIRE DURING DISCHARGE FOUNDER
OSWEGO PATRIOT	LIB	MID N. PACIFIC OFF LOS ANGELES, CA	5034	75	HIGH SEAS COLLISION STRUCTURAL DAMAGE
PETROGEN (PETRAGEN) ONE	PAN	ALGECIRAS, SPAIN	5034	85	NAVIGATING, FLOODED OR LEAKED, FOUNDER
VISHU	PAN	PHILLIPINE WATERS, NORTH S.E.ASIA	5034	89	COLLISION WITH DOCK
BOUCHARD 65 (BARGE)	USA	AMERICAN ATLANTIC O., MASSACHUSETTS	4986	74	UNDER TOW AGROUND
ENERGY DETERMINATION	LIB	STR. OF HORMUZ,40 MI-RAS AL KHAIMAH	4986	79	EXPLOSION,FIRE,TOWED,BROKE-IN-2,1/2-FOUNDERED
KOUNTOURIOTIS	GRE	STR. OF MALACCA, SUMATRA	4986	78	WEATHER FIRE
LYUDIK SVOBODA	RUS	BALTIC SEA AT VENTSPILS, LATVIA	4986	85	LOADING EXPLOSION FIRE FOUNDER
OSHIMA SPIRIT	PAN	PUNTA ARENAS-STR OF MAGELLAN, CHILE	4762	88	AGROUND
CABO PILAR	CHI	PUNTA ARENAS, STRAIT OF MAGELLAN	4704	87	WEATHER WINDS NAVIGATING, AGROUND
AGIP VENEZIA	ITA	160 KM OFF MALTA	4598	77	COLLISN
TRANSHURON	USA	KILTAN ISLAND - SW COAST OF INDIA	4414	74	MACHINE FIRE AGROUND ABANDON EXPLOSN
GEORGIA	NOR	PILOTTOWN, LA. LOW. MISS.R. MI. 0.2	4354	80	STRUCTR HOLED BY ANCHOR
ANTONIO GRAMSCI	RUS	OFF VENTSPILS LATVIA, USSR	4217	79	AGROUND
MONEMVASIA	GRE	SOUTH CHINA SEA, NR. SINGAPORE	4085	83	AGROUND REEF
EXXON NO. 32 (BARGE)	USA	OFF NORFOLK, VA	4082	85	UNSPECIFIED
PUERTO RICAN	USA	11 MI W. OF SAN FRANCISCO, CA	4049	84	EXPLOSN FIRE STRUCTR HULL RUPT BREAK-UP
ALAGIR	RUS	24 MI. N. OF CAPE FARINA NR TUNIS	3989	74	COLLISION W/ FRENCH M/V ALPILLES
ALBAHAA B	LIG	200 MI OFF DAR-ES-SALAAM, TANZANIA	3989	80	EXPLOSION BROKE-IN-2 FOUNDER
HANNAH 4001 (BARGE)	USA	AGROUND GALVESTON,TX	3989	81	EXPLOSION FIRE FOUNDER
MARIA ALEJANDRA	SPA	ATLANTIC O., OFF MAURITANIA,WAFRICA	3989	80	EXPLOSION FOUNDER
MYCENE	LIG	OFF SIERRA LEONE, W. AFRICA	3989	80	AGROUND LEAK FOUNDER TOWED SCUTTLED
PRINCESS ANNE-MARIE	GRE	CABO SAN ANTONIO, CUBA	3887	80	PERSONL AGROUND
BU 42 (BARGE)	USA	ARKANSAS R MI 66 NR PINE BLUFF, ARK	3829	82	CONTACT STRUCTR TANK & HULL RUPT
HEIWA MARU	JAP	SINGAPORE	3810	75	AGROUND
CHRISTOS BITAS	GRE	7 KM OFF WALES, UK	3718	78	AGROUND LEAKAGE SCUTTLED
(BARGE)	UNS	LOWER MISSISSIPPI R. MI. 694.5, AR	3554	84	AGROUND STRUCTR HULL RUPT
APEX HOUSTON (BARGE)	USA	PILOTTOWN, LA LOW. MISS. R. MI. 13	3407	81	COLLISN STRUCTR HULL RUPT
AREAS	LIB	MI. 130 LOWER MISS. R. MONTZ, LA	3407	82	COLLISN STRUCTR TANK RUPT
ALMAK	BRI	CURACAO, WEST INDIES	3401	84	UNSPECIFIED
US 218 (BARGE)	USA	LOWER MISS. R. MI180.8 DONALDSON LA	3401	83	COLLISN STRUCTR HULL RUPTURE
(BARGE)	UNS	NEAR BAYTOWN & GALVESTON, TX	3401	85	COLLISN W/ VESSEL STRUCTR HULL RUPT
SAFINA STAR	ARA	SUEZ CANAL, EGYPT	3389	77	AGROUND
O.N. 524331 (BARGE)	UNS	NEW ORLEANS, LA MISS. R. MI. 105	3265	74	COLLISN STRUCTR HULL RUPT
VENPET	LIB	32 KM OFF SOUTH AFRICA	3264	77	COLLISN W/ VENOIL FIRE
JAMBUR	IRQ	BOSPORUS STRAIT NR ISTANBUL, TURKEY	3239	90	WEATHER CAPSIZE FOUNDER
SANSINENA	LIB	LOS ANGELES HARBOR, CA	3239	76	EXPLOSN FIRE HULL RUPT BROKE-IN-2 FOUNDER
UMTB AMERICAN BARGE 283	USA	SOUTH OF SEMIDI ISLANDS, AK	3239	88	COLLISION
BROTAS	BRA	BRAZIL	3210	86	COLLISION
SEALIFT MEDITERRANEAN	USA	RONDO ISLAN,D STRAIT OF MALACCA	3156	78	CONTACT AGROUND
EXXON PUERTO RICO	USA	KENNER BEND ANCHORAGE N.ORLEANS, LA	3129	88	AGROUND STRUCT HULL RUPTURE
ELIAS	GRE	DELAWARE R., FT. MIFFLIN, PHIL., PA	2993	74	NAVIGATING, AGROUND
MYSELLA	BRI	STRAIT OF MALACCA, SINGAPORE	2993	76	EXPLOSION FIRE DURING UNLOADING, FOUNDER
TAKASE MARU	JAP	COAST OF OMAN, PERSIAN GULF	2993	78	UNSPECIFIED
ESSO REGULUS	PAN	CELEBES SEA?, BORNEO	2992	76	AGROUND
EXOTIC	LIB	ATLANTIC O. W. OF ESSAOUIRA,MOROCCO	2992	77	EXPLOSION FIRE FOUNDER
GOLDEN DOLPHIN	USA	700 MI. EAST OF BERMUDA, ATLANTIC O	2992	82	UNLOADED WEATHER EXPLOSION FIRE STRUC FOUNDER
HAKUYOH MARU	JAP	LIGURIAN SEA, GENOA, ITALY	2992	81	WEATHER-LIGHTENING EXPLOSION FIRE
KRITI SUN	GRE	STRAIT OF MALACCA, 3 MI SINGAPORE I	2992	75	EXPLOSION FIRE
NAI GIOVANNA	ITA	1,200 MI WSW SAN FRANCISCO, CA	2992	74	ANCHORED FIRE (SPON. COMBUST. OIL CAKES)
NAJD	ARA	JEDDAH, RED SEA, SAUDI ARABIA	2992	74	EXPLOSION FIRE
ST. MARY	LIB	MID-ATLANTIC, PORTUGAL	2992	74	EXPLOSION FIRE AGROUND
UNIVERSE DEFIANCE	LIB	S. ATLANTIC O., GUINEA	2992	77	COLLISION W/ SHIP AT SEA
FEOSO AMBASSADOR	PAN	QINGDAO, S CHINA SEA OFF HONG KONG	2857	83	AGROUND REEF
TSHOKU SEKIYU	UNS	SHIOGAMA, INLAND JAPAN	2820	78	UNSPECIFIED
B-421 /BARGE 1X(BARGES)	USA	LOWER MISSISSIPPI R. MI. 435.8, MS	2775	75	COLLISN STRUCTR HULL RUPT
E-24 (BARGE)	USA	ENTRANCE TO LONG ISLAND SOUND	2728	85	WEATHER FOUNDER
CHEVRON HAWAII	USA	DEER PARK, HOUSTON, TEXAS	2721	79	CONTACT FIRE STRUCTR HULL RUPT ABANDON

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
GLOBTIK SUN	BRI	185 MI. SW OF NEW ORLEANS, LA	2721	75	COLLISN
IOT-105 (BARGE)	USA	LOWER MISSISSIPPI R. MI. 639.5, MS	2721	75	UNLOAD WEATHER EXPLOSN FIRE FOUNDER HULL RUP
KINSEI MARU	JAP	SEA OF JAPAN	2721	85	COLLISN STRUCTR TANK RUPT
OLYMPIC GLORY	GRE	GALVESTON BAY, TX	2721	81	COLLISN STRUCTR HULL RUPT
SKYRON II	LIB	KM 155, SUEZ CANAL, EGYPT	2648	79	CONTACT AGROUND
HOSEI MARU	JAP	OFF HONSHU, JAPAN	2498	84	WEATHER COLLISN FIRE
QASOHA	SIN	S. CHINA SEA?, BORNEO	2493	81	FIRE
ABC 2311 (BARGE)	USA	MI 105, MISSISSIPPI RIVER	2481	74	CONTACT W/ BRIDGE FOUNDER
TEXACO NORTH DAKOTA	USA	100 MI SOUTH OF MORGAN CITY, LA	2449	80	CONTACT W/UNMANNED OILWELLHEAD EXPLOSION FIRE
KEYTRADER	USA	MISSISSIPPI R., LOUISIANA	2393	74	WEATHER COLLISION W/ BAUNE EXPLOSION FIRE
ELENI V.	GRE	NORTH SEA, NORFOLK, ENGL.	2390	78	WEATHER COLLISN W/ ROSELINE CUT-IN-2 FOUNDER
MARINA	GRE	SAO SEBASTIAO, BRAZIL	2381	85	CONTACT W/DOCK STRUCTR HULL RUPTURE
ASTORIA	GRE	EMDEN, WEST GERMANY	2322	79	CONTACT
ATHENIAN STAR	CYP	MID-ATLANTIC O. OFF NEW HAMPSHIRE	2313	75	WEATHER LEAKAGE STRUCTR
DEFIANCE	USA	CAPE FEAR, NORTH CAROLINA	2313	84	NOT SPECIFIED
UNIVERSE LEADER	LIB	BANTRY BAY, IRELAND	2293	74	PERSONL
HOEGH MASCOT	NOR	OUTSIDE COOS BAY, OREGON	2268	84	NOT SPECIFIED
SFI 41 (BARGE)	USA	MI. 43.7 UPPER MISS. R.-THEBES BR.	2218	85	COLLISN STRUCTR HULL RUPT
OCEAN 250 (BARGE)	USA	BLOCK ISLAND SOUND, RI	2211	78	UNDER TOW AGROUND STRUCTR HULL RUPT
PASADENA	LIB	SUEZ CANAL, EGYPT	2207	79	AGROUND
GRANTOR (BARGE)	DOM	CARIBBEAN SEA, SANTO DOMINGO	2194	89	AGROUND ON REEF
ELHANI	LIB	OUTSIDE SINGAPORE, INDONESIAN WATER	2190	87	AGROUND REEF HULL RUPT
BARGE 13	USA	RIVER/ESTUARY, LOUISIANA	2177	75	COLLISION WITH BRIDGE
AMAZZONE	ITA	ATLANTIC, POINTE DU RAZ, BRITTANY	2144	88	NAVIGATING STRUCTURAL DAMAGE LEAKAGE
NORD PACIFIC	SIN	CORPUS CHRISTI, TX INNER HARBOR	2089	88	RAMMED PIER HULL RUPTURED TANK
DAUNTLESS COLOCOTRONIS	GRE	MI. 89 MISS. RIVER, LOUISIANA	2041	77	STRUCTR HULL RUPT
GLORY	TAI	RAS TANURA, SAUDI ARABIA	2041	84	WEATHER STRUCTR HULL FRACTURE LEAKAGE
INTERSTATE 19 (BARGE)	USA	DELAWARE BAY, DE	2041	78	AGROUND
KOKKO MARU	JAP	GULF OF OMAN	2041	78	NAVIGATING
STUYVESANT	USA	VALDEZ, AK, GULF OF ALASKA	2041	87	EXPLOSN FIRE BROKE-IN-2 AGROUND
TANKER?	USA	OFF BRITISH COLUMBIA (0-3 MI.)	2041	87	CONTACT W/SUNKEN BARGE FIRE
VALPARAISIO	CHI	100 MI S OF PORT TALCAHUANO, CHILE	2041	86	ERROR AT TERMINAL, MACHINE EQUIPMENT FAILURE
HONAM JADE	LIB	1.6 KM OFF YOSU, S. KOREA	2021	83	AGROUND STRUCK BOTTOM
AEGIS LEADER	GRE	ABU DHABI, PERSIAN GULF	1995	74	LEAKING
ANSON	CYP	ORINOCO R., VENEZUELA	1995	77	FIRE
ANTIPOLIS & ROMELIA (LIB)	GRE	AFRICAN INDIAN OCEAN, S. AFRICA	1995	77	TYPHOON STRUCTURAL DAMAGE
CLAUDE CONWAY	PAN	150 MI. SE CAPE FEAR, S. CAROLINA	1995	77	COLLISION W/ ST BRIGHT DUKE, FIRE
DRUPA	BRI	TANANGER, NORWAY	1995	76	AGROUND STRUCTR HULL RUPT
ERCOLE	ITA	MI 174.2 MISSISSIPPI RIVER, LA	1995	74	LEAKING/FLOODING FIRE ABANDON FOUNDER
MARIN MIST (BARGE)	USA	PORT, CALIFORNIA	1995	83	LOADING EXPLOSION SCUTTLED
MERCATOR	LIB	ATLANTIC O. OFF PORTUGAL	1995	87	EXPLOSION BROKE-IN-2 HALF-SCUTTLED HALF-TOWED
PACIFIC COLOCOTRONIS	GRE	DUTCH REGION, NORTH SEA	1995	75	WEATHER AGROUND
PANGLOBAL FRIENDSHIP	LIB	CARRIBEAN ZONE, 20 MI OFF TRINIDAD	1995	75	UNDER TOW AGROUND
PANTAS	SIN	STR. OF MALACCA OFF BATU PAHAT	1995	86	LEAKAGE STRUCTR
PUNTA DELGADA	ARG	LA PLATA ROADS,NR BUENOS AIRES, ARG	1995	85	WEATHER, TOWLINES BROKE, AGROUND
RYOYO MARU	JAP	BUNGO STRAIT, JAPAN	1995	76	AGROUND
SASCHA	SIN	MAKASSAR STRAIT, OFF BORNEO	1995	81	WEATHER AGROUND
SHELL 2 (BARGE)	USA	MID NORTHERN PACIFIC OCEAN, GUAM	1995	75	FIRE FOUNDER
TWE 23 DE AGOSTO	CUB	CARIBBEAN SEA, PORT IN CUBA	1995	89	UNLOADING ERROR
ORLEANS	GRE	OFF NORFOLK COAST OF ENGLAND	1973	86	COLLISN
STUYVESANT	USA	GULF OF AK, 100-200 MI. OFF BRIT C	1944	87	WEATHER STRUCTURE TANK RUPTURE LEAKAGE
SP171 & SP172 (BARGE)S	USA	MILE 435.8 MISS. RIVER	1911	83	CONTACT W/BRIDGE STRUCT
MAYSUN	PHI	55 MI OFF NOGAS ISLAND, PHILLIPINES	1905	86	OFFLOADING EXPLOSN FIRE HULL RUPT FOUNDER
TTT-103 (BARGE)	USA	INTERCOAST. WTRWY., PASCAGOULA, MS	1905	86	FOUNDER
CHEM102(BARGE)	USA	LOWER MISSISSIPPI R. MI. 123.0, LA	1882	84	COLLISN STRUCTR TANK RUPTURE
ENERGY ENDURANCE	LIB	OFF EAST LONDON, SOUTH AFRICA	1798	81	WAVE
ELENI S.	PAN	12 MI. EAST OF LAGOS, NIGERIA	1795	87	STRUCTRL LEAK ABANDON FOUNDER
TOBA MARU	JAP	STR. OF MALACCA, SINGAPORE	1713	75	COLLISN W/CACTUS QUEEN EXPLOSION FIRE
PETER MAERSK	DAN	ENGLISH CHANNEL, FRANCE	1695	74	COLLISN
CHRISTINA II	GRE	OFF DUTCH COAST	1677	75	WEATHER
AMAZON VENTURE	LIB	RIVER AT SAVANNAH, GEORGIA	1620	86	UNDER TOW AGROUND STRUCTR HULL RUPT
CORINTHOS	LIB	MARCUS HOOK, DELAWARE RIVER, PA	1620	75	VALVE FAILURE
Z-102 (BARGE)	USA	PUERTO RICO	1620	75	COLLISN EXPLOSN FIRE HULLRUPT LEAKAGE FOUNDER
AL DURIYAH	LIB	MADIQ GUBAL, GULF OF SUEZ	1613	83	AGROUND STRUCK REEF
SEA VALIANT	LIB	N. ATL. 800 MI. N. OF AZORES	1501	79	WEATHER STRUCTR
PECK SLIP (BARGE)	USA	CAPE SAN JUAN, PR	1497	78	WEATHER AGROUND LEAKAGE TANK RUPT
CHRISSI	GRE	PSITTALIA I., MEDITER. SEA, GREECE	1496	78	FIRE EXPLOSION
HITRA	NOR	N. SEA, WEST GERMANY	1496	79	ANCHORED FOR REPAIRS FIRE EXPLOSION
IRIS	GRE	MEDITERREAN SEA, GREECE	1496	82	ANCHORED FOG COLLISION W/ DOCKED SHIP
MOBIL SERVICE 2	SIN	STRAIT OF MALACCA	1496	79	COLLISION W/HOLSTENSAND FOUNDER
PATIANNA	LIB	PERSIAN, 7 MI. OFF DUBAI, UAE	1496	79	AGROUND
PNOC TRANSMAR	PHI	PACIFIC O., LUZON, PHILLIPINES	1496	80	AGROUND HULL RUPTURE
CAPAHUARI	PER	1 MI. FROM PORT OF SUPE, PERU	1490	90	PILOT ERROR, AGROUND
BETHIOUA	ALG	TAMAR RIVER, TASMANIA	1476	76	AGROUND
JOS. SIMARD	CAN	NEWFOUNDLAND, CANADA	1458	74	MACHINE
GRAND EAGLE	PAN	MARCUS HOOK, PA DELEWARE RVR	1409	85	AGROUND STRUCTR TANK RUPT
ETHEL H (II) (BARGE)	USA	HUDSON RIVER, NEW YORK	1361	77	NAVIGATIONAL ERROR AGROUND
N 30 (BARGE)	TRI	AMERICAN ATLANTIC, TRINIDAD, CUBA	1361	76	UNDER TOW AGROUND STRUCTR TANK RUPT
WORLD PRODIGY	GRE	NARAGANSETT BAY, RI BRENTON REEF	1361	89	LEAK OR FLOODING
TSESIS	RUS	NEAR STOCKHOLM, SWEDEN	1306	77	WEATHER AGROUND LEAKAGE

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
HAN CHEONG	KOR	PALAU ISLANDS, GUAM PACIFIC OCEAN	1296	80	EMERG DDISCHG
AMERICAN TRADER	USA	1 1/2 MILES OFF HUNTINGTON BEACH CA	1287	90	HULL RUPTURE ON ANCHOR AT UNLOADING BUNKER
SEALIFT PACIFIC	USA	COOK INLET, ALASKA	1282	76	AGROUND STRUCTR HULL RUPT
OSWEGO GLORY	UNS	ATLANTIC OCEAN	1265	77	AGROUND
CORINTHIAN	LIB	OFF FUJAIRAH, UAE	1260	82	EXPLOSION FIRE SCUTTLED
BRIMSTONE (BARGE)	USA	KENNER, LOUSIANA	1224	80	COLLISN STRUCTR HULL RUPT
HBL 3011 (BARGE)	USA	KENNER, LA LOWER MISS. R. MI. 112.0	1224	80	COLLISION
RF-1001 (BARGE)	USA	CHALMETTE, LA, 1 MI. N., MISS.	1224	85	AGROUND STRUCTR HULL RUPT
TEXAS (BARGE)	USA	UPPER MISS. R. MI. 43.4, THEBES, IL	1224	86	COLLISN CAPSIZE
TM-10 (BARGE)	UNS	GALVESTON, TEXAS	1224	74	LEAKAGE FOUNDER
MICHAEL C. LEMOS	GRE	ST. CROIX, U.S. VIRGIN ISLANDS	1218	75	AGROUND STRUCTR HULL RUPT
USS ROANOKE	USA	ENTRANCE TO PEARL HARBOR, HA	1213	84	AGROUND
VECTOR/COLL. W/ DONA PAZ	PHI	PHILIPPINES BTW MINDORO-MARINDUQUE	1199	87	COLLISION W/ FERRY DONA PAZ EXPLOSION FIRE
INEZ 2	BEL	NORTH SEA, NETHERLANDS	1197	79	CONTACT WITH STONE EMBANKMENT
RHEINTANK 24	WGE	RHEIN R-40 KM SW OF FRANKFURT, W.GER	1197	89	AGROUND
GEPO KOLN	WGE	ROTTERDAM, NETHERLANDS	1182	79	PERSONL
HUA YUN 4	TAI	OFF SHIKOKU I, JAPAN	1182	86	COLLISN
APHRODITE B	GRE	HARVEY, LA	1166	81	COLLISN
LUKHOVITSY	RUS	CUNFUEGOS (CIENFUEGOS) HARBOUR,CUBA	1156	86	OFFLOADING ERROR
PECK SLIP (BARGE)	USA	ATLANTIC OCEAN BAHAMAS	1130	76	LEAKAGE
BARGE 3	USA	GULF OF MEXICO-CHANNEL IN LOUISIANA	1097	74	COLLISION W/DIONNE MARIE STRUCT
ROSEBAY	LIB	24 MI SE OF PLYMOUTH,ENG.-ENG.CHAN.	1097	90	COLLISON W/ OBJECT FLOATING IN WATER
APEX 2904 (BARGE)	USA	ARKANSAS R. MI. 6.5, PINE BLUFF, AR	1088	82	ERROR AT TERMINAL
AURIGA PRIMO	ITA	PORT BLACK SEA BOSPHOROUS STRAIT	1088	79	CONTACT W/ BRIDGE AGROUND
HAPPY KARI	UNS	JEDDAH, SAUDI ARABIA, RED SEA	1020	88	HULL FAILURE
AKARI	PAN	BETWEEN DUBAI & JEBEL ALI U.ARAB.E.	1007	87	WEATHER ELECTRICAL FIRE LISTING AGROUND
ALGOL	BRI	CARRIBEAN SEA OFF PANAMA	997	82	WEATHER STRUCTUR
ARIES	PAN	PACIFIC O.,W.COAST MEX.,BAHIA BAMBA	997	75	AGROUND
ASIATIC	PAN	STR. MALACCA,PORT DICKERSON,SUMATRA	997	75	FIRE FOUNDER
ASTRON	PAN	20 MI. NW CABO ENGANO LIGHT-DOM REP	997	78	TANK-CLEANING EXPLOSION FIRE
ATLAS TITAN	LIB	SETUBAL, PORTUGAL	997	79	FIRE
BOMIN 2	SIN	NORTH SEA, SCOTLAND	997	79	WEATHER LEAK FOUNDER
CAMPONAVIA	SPA	ALGECIRAS BAY, SPAIN	997	85	WEATHER AGROUND
CASSIOPEIA	GRE	CARRIBEAN SEA, COLUMBIA	997	78	ANCHORED NEAR COAST WEATHER AGROUND
CHERRY DUKE	SIN	17 MI. OFF DAS I., PERSIAN GULF	997	79	WEATHER COLLISION W/BETTY
CHOYO MARU	JAP	17 MI. N. OF BALI I., FLORES SEA	997	79	BROKE-IN-2 FOUNDER
CHRISTINA	GRE	BALTIMORE, MARYLAND	997	76	COLLISION W/HINODE MARU NO. 58
CORONA ENERGY	LIB	PACIFIC O., MEXICO	997	76	AGROUND FIRE
DELSAN 1	PHI	PACIFIC O.?, PHILIPPINES	997	79	AGROUND ON REEF
FEOSO SUN	PAN	MANILA BAY, PHILLIPINES	997	78	UNDER TOW, AGROUND
FORTUNA	HON	REEF, S. CHINA SEA?, BORNEO	997	79	BROKEN TOW LINE, AGROUND
FUKUYOSHOMI MARU	JAP	SEA OF JAPAN OFF HONSHU	997	82	WEATHER ANCHORED AGROUND
GATAPETROL	CYP	EASTERN MEDITERRANEAN SEA, LEBANNON	997	76	AGROUND
GOLDEN STAR (BARGE)	SWE	BALTIC SEA, SWEDEN	997	76	FIRE
H ENDURANCE	CYP	FREETOWN, SIERRA LEONE, W. AFRICA	997	74	WEATHER AGROUND WHILE AT ANCHOR
IDAN	GRE	GULF OF MEXICO, S. OF LOUSIANA	997	78	AT ANCHOR, WEATHER, EXPLOSION, FIRE, FOUNDER
JOHN COLOCOTRONIS	GRE	MINIEH, NEAR TRIPOLI, LEBANON	997	74	EXPLOSION FIRE FOUNDER
JOSE MARTI	RUS	OFF DALARO, SWEDEN	997	81	AGROUND
JULY STAR	SIN	WESTERN MEDITERRANEAN SEA, ALGERIA	997	75	AGROUND FIRE
MIN WOO 5	KOR	EAST CHINA SEA?, BUSAN, S. KOREA	997	81	EXPLOSION FIRE FOUNDER
ROVER STAR	PAN	GULF OF OMAN, 30 MI. OFF MUSCAT	997	84	ANCHORED CAUGHT FIRE
RYOKA MARU 101 (BARGE)	JAP	PACIFIC O., OFF HONSHU JAPAN	997	78	AGROUND
SAMIR	MOR	PONT BLONDIN NR CASABLANCA, MORROCO	997	82	FIRE FLOODING
SAN ROCCO	LIB	CARIB., 1 MI. W CAYO LIMON,DOM.REP.	997	75	EXPLOSION FOUNDER
SHANTA SHIBANI 2	PAN	S.CHINA SEA, VIETNAM	997	89	UNLOADING, FIRE
SILJESTAD	NOR	PERSIAN GULF, DUBAI	997	77	FIRE
SOUTHERN SUN	LIB	MED. SEA, ZUETINA OIL TERM., LYBIA?	997	76	WEATHER AGROUND
TEXACO BRISBANE	BRI	NEAR BORNEO	997	77	COLLISION W/ SHIP
TRAMONTANA	FIN	MAURITIUS I., AFRICAN INDIAN OCEAN	997	75	LOADING, EXPLOSION FROM MT PETRAGEN ONE, FIRE
TRINITY NAVIGATOR	LIB	MEDITER. SEA, MARSA EL BREGA, LIBYA	997	76	EXPLOSION STRUCTURAL BROKE-IN-2 TOWED
VOLGONEFT 263	RUS	10 MI. SE OF KARLSKRONE, SWEDEN	997	90	AGROUND
ZEPHYROS	GRE	PERSIAN GULF, TURB I., IRANIAN WAT	997	79	STEERING PROBLEMS AGROUND
ASTRO LEO	PAN	OFF JAPAN	993	77	UNLOADING AT PORT, TERMINAL ERROR
BARGE 8	BRI	HONG KONG, ANCHORED NEAR COASTLINE	993	79	NAVIGATING, AGROUND ON REEF
CHARALAMBOS	GRE	GULF OF MEXICO, YUCATAN, MEXICO	993	82	NAVIGATING STRUCTURAL DAMAGE
DAGNY	UNS	CORPUS CHRISTI, TEXAS	993	74	UNSPECIFIED
DEVALI I	LIB	AMERICAN ATLANTIC SANTO DOMINGO	993	79	NAVIGATING, STRUCTURAL HULL DAMAGE
MAROFA	POR	NEAR CAPETOWN W. AFRICA	993	82	LEAK OR FLOODING
NISA	POR	ATLANTIC OCEAN PORTUGESE WATERS	993	87	NAVIGATING, COLLISION WITH SHIP, FIRE
LAKE ANJA	NOR	ENGLISH CHANNEL, UK	988	80	COLLISN
TEXACO 897 (BARGE)	USA	MI. 7 LOWER BAY NEW YORK HARBOR, NY	978	87	WEATHER HULL RUPTURE
KATINA	GRE	OFF HOOK OF HOLLAND, NETH.	972	82	COLLISN
KOSHUN MAR	JAP	TOKYOWAN, JAPAN	972	85	ANCHOR
NEPCO 140 (BARGE)	USA	ST. LAWRENCE SEAWAY, NY MI. 66.0	972	76	HUMAN ERROR DROPPED ANCHOR WHILE UNDERWAY
PRESIDENTE RIVERA	URU	MARCUS HOOK, PA -DELAWARE RIVER	972	89	UNDER TOW WEATHER AGROUND STRUCTR HULL RUPT
DOMAR 115 (BARGE)	USA	PASCAGOULA, MS- HORN I. PASS OFF LA	952	88	AGROUND STRUCTUR HULL RUPTURE
ATHOS	FRE	PAULSBORO, NEW JERSEY	923	74	COLLISN STRUCTR HULL RUPT
GREMONA	SPA	BAHRAIN, ARABIAN GULF	913	80	PERSONL VALVE LEFT OPEN
RICHARD C. SAUER	LIB	PERTH AMBOY, NEW JERSEY	898	76	COLLISN AGROUND STRUCTR HULL RUPT
ESSO BERNICIA	BRI	SHETLAND ISLAND, UK	898	78	WEATHER FIRE CONTACT

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
CITTA DI SAVONA	ITA	STRAIT OF MALACCA, SINGAPORE	883	76	COLLISN
BOTANY TRIAD	PAN	OFF CAPE ST. FRANCIS, S.AFRICA	875	85	COLLISN
ESSO BAYWAY	LIB	NECHES RIVER, TEXAS	859	79	AGROUND ON ANCHOR, STRUCTR, TANK RUPT
VIKING OSPREY	SIN	MARCUS H,DELAWARE R,GIBBSTOWN,NJ/PA	857	86	AGROUND STRUCTR HULL RUPT
OLYMPIC DREAM	GRE	3 MI. OFF VLISSINGEN, NETHERLANDS	855	87	WEATHER COLLISION FIRE STRUCTR LISTING
NAUTILUS	BRI	KILL VAN KULL, NJ NEAR BAYONNE	842	90	AGROUND WHILE DOCKING
SIVONA	SWE	OFF S. COAST OF SWEDEN NR HOOANAS	842	82	COLLISN
COASTAL TOWING BARGE 2514	USA	GALVESTON BAY, TX	816	89	UNLOADING FIRE
DOMAR 6501 (BARGE)	USA	POINT AU FER, LA, ATCHAFALYA BAY	816	78	COLLISN W/ SHIP STRUCTR TANK RUPT
SAN MARCO	PAN	STRAIT OF MALACCA, PENANG	816	78	COLLISION WITH PANAMANIAN TANKER RACHEL B
SOUTHWEST CAPE	LIB	OFF PERTH AMBOY, NJ	816	80	COLLISN
DONAU MARU	JAP	BOSTON, MASSACHUSETTS	810	79	PERSONL MACHINE
STCO-101 (BARGE)	USA	CHESAPEAKE BAY, VA (MD?)	809	76	OTHER STRUCTR HULL RUPT FOUNDER?
AL AKABAR 2	ARA	N. INDIAN OCEAN, PAKISTAN	798	85	COLLISION W/ SHIP
CAPULONIX	LIB	NORTHERN INDIAN OCEAN, INDIA	798	75	AGROUND
GOLDEN SUN	HON	S. CHINA SEA?, BORNEO	798	79	WEATHER MACHINE AGROUND STRUCT FLOOD
HAGENSEE	WGE	EUROPEAN ATL. PORT/TERMINAL, FRANCE	798	74	FLOODING/LEAK
KARAHASAN	TUR	BLACK SEA/BOSPHORUS, TURKEY	798	80	EXPLOSION
OLYMPIC BRAVERY	LIB	1 MI NE CREAC'H LIGHT,USHANT I,FRAN	798	76	NAVIGATING COLLISION W/ SHIP AT SEA
LIGHT CANSO	UNS	STRAIT OF CANSO, NOVA SCOTIA	784	79	AGROUND
MATTHEW/CHRISTINA (BARGE)	USA	RIVER, NEWBURGH, NEW YORK	777	83	AGROUND STRUCTR HULL RUPT
ARCO ANCHORAGE	USA	PORT ANGELES, PUGET SOUND, WA	774	85	WEATHER AGROUND STRUCTR HULL RUPT
VISAHAKIT I	THA	GULF OF THAILAND	767	74	COLLISN
JACUI	BRA	QINGDAO, CHINA	761	84	AGROUND
STOLT OSPREY	LIB	OFF YOKOHAMA, JAPAN	761	84	COLLISN
GREY HUNTER	BRI	POINT EUROPA, GIBRALTAR	758	79	AGROUND LEAKAGE
(BARGE)	USA	GULF OF MEXICO, TX	742	84	UNKNOWN
BARGE NESTUCCA	USA	WESTPORT, WA 25 MI OFF GRAYS HARBOR	736	88	COLLISION W/TUG BOAT DURING TOWING
FLORIDA (BARGE)	USA	ILLINOIS? R. MI. 214.5, IL	729	76	AGROUND STRUCTR TANK RUPT
CEPHEUS	GRE	2.5 KM FROM ANCHORAGE NR PALMER, AK	713	84	AGROUND STRUCTR HULL RUPTURE
OSWEGO HOPE	LIB	PERTH AMBOY, NEW JERSEY	711	76	CONTACT
WORLD HORIZON	LIB	AFRICAN/INDIAN OCEAN	707	78	NAVIGATING, STRUCTURAL DAMAGE
KATINA M.	CYP	STRAIT OFF JAPAN	706	74	COLLISN W/ SHIP
IB 2903	USA	UPP. MISS. R. MI. 301, HANNIBAL, MO	703	86	COLLISN STRUCTR TANK RUPT
AL SOREYA	BRI	PERSIAN GULF, ABU DHABI	698	79	WEATHER AGROUND
ANTONIO GRAMSCI	RUS	6 MI OFF PORVOO, GULF OF FINLAND	698	87	UNDER TOW AGROUND
ELK RIVER (BARGE)	USA	RIVER OR ESTUARY, VIRGINIA	698	76	COLLISION W/ SHIP
FUKUTORU MARU 8	JAP	OFF JAPAN	698	82	AGROUND AT FULL SPEED
GULF ACE	PHI	ENTRANCE TO PORO, PHILLIPINES	698	81	AGROUND
PATMOS	GRE	STRAIT OF MESSINA OF SICILY	698	85	COLLISN W/SHIP FIRE AGROUND
WILLIAM WHEELWRIGHT	BRI	ATLANTIC O., WEST AFRICA, LIBERIA	698	75	UNLOADING EXPLOSION FIRE
SERIA	HOL	SUEZ CANAL, EGYPTIAN WATERS	694	76	NAVIGATING, AGROUND
APEX 104	USA	ATCHAFALAYA R., SIMMESPORT, LA	687	90	UNDER TOW, CONTACT W/BRIDGE
EASTERN CARRIERS BARGE 565	USA	CHESAPEAKE BAY NEAR KILMARNOCK, VA	687	88	STRUCTUR BREAKUP AGROUND
BOUCHARD NO. 100 (BARGE)	USA	LONG ISLAND SOUND, NY	680	78	AGROUND HULL RUPT
BUTANE (BARGE)	USA	NEW ORLEANS, LA MISS. R. MI. 102.0	680	75	UNDER TOW STRUCTR HULL RUPT LEAK
B. 450-3 (BARGE)	UNS	NEAR PORT ARTHUR, LA	680	82	PERSONL AGROUND LEAK STRUCTR HULL RUPT
MOBIL OIL	USA	MI.88 COLUMBIA R. NEAR PORTLAND, OR	680	84	COLLISN STRUCTR HULL RUPT
NAT.MAR.SERV. 3105(BARGE)	USA	GALVESTON BAY, TEXAS	680	76	UNDER TOW COLLISN W/ SHIP STRUCTR HULL RUPT
NO. 102 (BARGE)	USA	ST. LOUIS, MO UPPER MISS. R. 168.5	680	78	COLLISN STRUCTR TANK RUPTURE
OCEAN CITIES (BARGE)	USA	GULF OF MEXICO, LA (12-200 MI.)	680	80	MACHINE STEERING AGROUND STRUCTR HULL RUPT
V882,883,884,885 (BARGE)S	USA	U. MISS. R. MI. 179.2 ST. LOUIS, MO	675	83	CONTACT W/BRIDGE STRUCTR TANK RUPT
GLACIER BAY	USA	COOK INLET 8KM S. OF KENAI, AK	674	87	AGROUND ROCK STRUCTR HULL
BARGE (FONTON)	UNS	EAST KALIMANTAN, INDONESIA	654	85	UNSPECIFIED
21 SANYO MARU	JAP	EAST CHINA SEA OFF KYUSHU, JAP	648	85	EXPLOSION FIRE BROKE-IN-2
SOMA MARU (CARGO VESSEL)	JAP	OFF KAWASAKI, JAPAN	648	84	COLLISN
UNIREA	RUM	30 MI. E. OF CAPE ERMINE, BUL.	648	82	AGROUND
NORDIC FAITH	BRI	STRAIT OF BOSPORUS, TURKEY	648	80	COLLISN
STAWANDA	GRE	STRAIT OF BOSPORUS, TURKEY	639	80	COLLISN
WORLD PROTECTOR	GRE	BOMBAY HARBOR, INDIA	630	79	CONTACT
(BARGE)	UNS	EAST KALIMANTAN, INDONESIA	619	85	UNSPECIFIED
INTERSTATE 30 (BARGE)	USA	DELEWARE? R. NEAR PHILADELPHIA, PA	612	79	COLLISN STRUCTR HULL RUPT
NICOS I VARDINOYANNIS	GRE	WILHELMSHAVEN, WEST GERMANY	599	77	AGROUND
BUM HAN	KOR	PACIFIC O., KOREA	598	76	UNDER TOW LEAK
CAPITAN W ARVELO	DOM	CARIBBEAN SEA, SANTO DOMINGO	598	89	COLLISION W/ DOCK IN A LOCK
CAROLINE (BARGE)	USA	NEW YORK	598	77	AGROUND
GEORGE WHITLOCK 2 (BARGE)	USA	ATLANTIC O., NEW YORK	598	78	UNLOADING EXPLOSION FIRE BROKE-IN-2
LAURA SECURITY	PAN	REEF, S.GULF OF SUEZ-RED SEA, EGYPT	598	83	AGROUND
PERITO MORENO	ARG	BUENOS AIRES, ARGENTINA	598	84	AGROUND ON REEF FOUNDER
PETRO ROUSCAT	FRE	RIVER IN CAMEROON, W. AFRICA	598	79	AGROUND
SAVPUEL	HON	LIGHTHOUSE REEF-BELIZE, BRI. HOND.	598	74	COLLISION W/ SHIP AT SEA
ARCTIC LINK	UNS	LAKE MELVILLE, LABRADOR	590	84	GROUNDING
DXE 3006 (BARGE)	USA	MI 43.7 U. MISS.R., IL THEBES BRIDGE	585	85	COLLISN W/ BRIDGE STRUCTR HULL RUPT
PAHIRE GUNERI	TUR	OFF IZMIR, TURKEY	577	84	AGROUND HULL RUPT
SCHELDERIX	LIB	DURBAN, S. AFRICA	571	81	NAVIGATING RAMMING CRACK IN HULL PLATING
BAHIA PARAISO SUPPLY SHIP	ARG	600 MI. S. OF CAPE HORN, CHILE	551	89	AGROUND FLOOD FOUNDER
TEXACO CONNECTICUT	USA	GAMBOA, PANAMA CANAL ZONE	551	80	AGROUND STRUCK BANK
BW 1033 (BARGE)	USA	LOWER MISS. R. MI. 791.8, TENNESSEE	544	85	AGROUND STRUCTR HULL RUPT
CHOTIN 2181X (BARGE)	USA	OHIO RIVER MI. 809.6, KY	544	75	COLLISN STRUCTR HULL RUPTURE
EXXON BARGE NO. 241	USA	MI. 735 LOWER MISS. R., MEMPHIS, TN	544	88	COLLISN STRUCTR HULL RUPT

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
IOT-182 (BARGE)	USA	GULF INTERCOAST WTRWY MI. 23.5, LA	544	77	COLLISN EXPLOSN FIRE
PINA	LIB	NEW ORLEANS, LA	544	79	AGROUND COLLISN STRUCTR HULL RUPT
STCO 227 (BARGE)	USA	BAYTOWN, TEXAS	544	80	COLLISION IMPROPERLY SECURED HULL RUPTURE
STCO-228 (BARGE)	USA	TEXAS CITY, TEXAS	544	79	COLLISN STRUCTR TANK RUPT
CELESTE	PAN	ORINOCO RIVER, VENEZUELA	530	77	AGROUND
SJT-4 (BARGE)	UNS	CHALMETTE, LA MISS. R. MI. 88.8	518	76	CONTACT STRUCTR HULL RUPT
(BARGE)	UNS	ST. MARTINVILLE, LA	510	74	COLLISN STRUCTR HULL RUPT
AEGIS LEADER	GRE	OFF SUMATRA	502	78	MACHINE AGROUND
AMERICAN EAGLE	USA	100 MI. SW OF NEW ORLEANS, LA	499	84	AGROUND
ANNA XYLA	GRE	JEBEL DHANNA, PERSIAN G., ABU DHABI	499	91	EXPLOSION FIRE ABANDON AGROUND
ATHENIAN VICTORY	GRE	GULF OF ADEN, DJIBOUTI	499	78	COLLISION W/ DOCK
BELLONA	NOR	BALTIC SEA, SWEDEN	499	83	FIRE
BENENTANK (BARGE)	BEL	RIVER NEAR N. SEA OFF BELGIUM	499	82	AGROUND
BLOSSOM	LIB	50 MI. W. OF SARDINIA	499	80	COLLISION W/ SHIP
CAPETAN MATHIOS	GRE	W. OF ANDROS I., CARIBBEAN, BAHAMAS	499	76	AGROUND
CARIBBEAN NAVIGATOR	PAN	PACIFIC O., PANAMA	499	89	AGROUND EXPLOSION FIRE
CATHERINE Y	PAN	PACIFICO 3 MI.OFF CORINTO,NICARAGUA	499	84	WEATHER COLLISION EXPL FIRE STRUCT ABANDON
CELTIC LEE	BRI	LEE RIVER AT CORK, IRELAND	499	79	AGROUND
COWRBH (BARGE)	SL.	ATLANTIC O., SIERRA LEONE	499	85	AGROUND
DELSAN 2	PHI	PACIFIC O.?, REEF OFF PHILLIPINES	499	80	FIRE
DIMITRIOS D M	LIB	PACIFIC O.?, PANAMA	499	75	CONTACT AGROUND
DONG WHA 13 (BARGE)	KOR	OFF IKITSUKI I, NAGASAKI, JAPAN	499	76	AGROUND LEAK
EKFJORD	SWE	BALTIC SEA, SWEDEN	499	85	FIRE AGROUND
ERIK	PAN	N. SEA, GREAT BRITAIN	499	87	UNDER TOW, COLLISION
EXXON 119 (BARGE)	USA	GULF OF MEXICO, TEXAS	499	77	UNLOADING EXPLOSION FIRE
FUJI	PAN	20 MI. SE OF CAPE HATTERAS, NC	499	85	COLLISION W/ MT EXPLOSION FIRE AGROUND
FUJIASU MARU 1	JAP	JAPAN	499	77	AGROUND
GIM 200 (BARGE)	USA	GULF OF MEXICO, ALABAMA	499	78	WEATHER AGROUND
GLOBAL HOPE	GRE	SALEM SOUND, MASSACHUSETTS	499	78	WEATHER LEAK/FLOODING
GOGO RIDER	BRI	GULF OF ADEN/INDIAN O., SOCOTRA I.	499	81	NAVIGATING, AGROUND
GOLDEN ROBIN	BRI	GULF OF ST. LAWRENCE,N.BRUN.,CANADA	499	74	COLLISION W/ SHIP
GREAT LOYALTY	LIB	STRAIT OF MALACCA, SINGAPORE	499	74	EXPLOSION,BROKE-IN-2,1/2 FOUNDER,TOW AGROUND
HOZAN MARU 8	JAP	PACIFIC O.?, OFF JAPAN	499	83	CONTACT W/ DOCK
IBN ROCHD	MOR	BALTIC SEA OFF DENMARK	499	84	RADAR BREAKDOWN AGROUND
IOANNA	GRE	GALIOLA I., RIJEKA, YUGOSLAVIA	499	75	AGROUND
IRENES SINCERITY	GRE	ARABIAN SEA, 100 MI. SW OF KARACHI	499	81	STEERING AGROUND HULL RUPT TOWED FIRE FLOOD
IRENES SINCERITY	CYP	BALTIC SEA, SWEDEN	499	76	AGROUND
IRVINGWOOD	CAN	ST. LAWRENCE R., QUEBEC, CANADA	499	74	COLLISION W/SHIP
JANILL	PAN	CARIBBEAN, PUERTO CORTEZ, HONDURAS	499	76	EXPLOSION FIRE LEAK BROKE-IN-2 FOUNDER
KOREA HOPE	KOR	STRAIT OF MALACCA, SINGAPORE	499	74	COLLISION W/SHIP
LUCKY ERA	CYP	EASTERN REEF, MAYAGUANA I., BAHAMAS	499	75	WEATHER CONTACT W/ DOCK STRUCTURAL
MAASSLUIS	HOL	W. MEDITERRANEAN, ALGERIA	499	89	ANCHORED WEATHER LEAK AGROUND
MAKIS	GRE	MEDITERRANEAN SEA, LIBERIA	499	77	UNLOADING FIRE
MANHATTAN DUKE	LIB	BASILISK REEF,PORT MORESBY,N.GUINEA	499	83	WEATHER LEAK
MARIA THERESA	GRE	GULF OF OMAN, PAKISTAN	499	78	CONTACT W/ QUAYSIDE STRUCT FOUNDER
MARIHERON	PAN	MUSI R., PALEMBANG, SUMATRA	499	79	COLLISION W/ SHIP
MESURADO	LIB	2 MI. OFF LOWER BUCHANAN, LIBERIA	499	76	AGROUND
MONMOUTH	USA	NORTHERN INDIAN OCEAN, ASIA - INDIA	499	74	LOADING EXPLOSION FIRE FLOODING AGROUND
NAGATO MARU 6	JAP	PACIFIC O., STRAIT OFF JAPAN	499	83	WEATHER AGROUND
NAPO	ECU	CARRIBEAN, CUBA	499	85	AGROUND
NELY P	GRE	MEDITERRANEAN SEA OFF ITALY	499	80	AGROUND
NIKKO MARU	JAP	STRAIT, S. CHINA SEA, SINGAPORE	499	74	FIRE
NOVOROSSISKIY PARTIZ	RUS	BOSPHORUS STRAIT, OFF TURKEY	499	83	AGROUND
OKTAVIUS	SWE	BALTIC SEA, SWEDEN	499	78	LEAK FLOODING FOUNDER
OLYMPIC DALE	LIB	ANTARTICA	499	75	FIRE
ORIENTAL NAVIGATOR	LIB	PACIFIC O.?, PHILLIPINES	499	82	AGROUND
PALVA	FIN	MID-ATLANTIC	499	79	DEGASSING EXPLOSION BROKE-IN-2
PAVLOS V	GRE	MEDITERR. SEA, OFF W TIP OF SICILY	499	78	COLLISION W/ SHIP
RIVA I	PAN	GULF OF AQABA, ELIAT, ISRAEL	499	81	WEATHER AGROUND LEAK
SAN NIKITAS	GRE	GULF OF BOTHNIA, BALTIC SEA, SWEDEN	499	83	AGROUND
SANSHO MARU	JAP	PACIFIC O., OFF JAPAN	499	85	CAPSIZE LEAK FOUNDER
SEPIR	SWE	BALTIC SEA, SWEDEN	499	81	WEATHER ICE LEAK/FLOODING
SINODA	LIB	IZU I., 30 MI. FR MIKURASHIMA, JAP	499	85	WEATHER AGROUND
SITIAWAN	MLS	S. CHINA SEA?, PORT OFF MALAYSIA	499	84	COLLISION W/ SHIP
TEKTON	LIB	INDIAN O. OFF DURBAN S. AFRICA	499	74	COLLISON W/ SHIP IN A CHANNEL
VALNY	PAN	RED SEA OFF EGYPT	499	80	UNLOADING, PIPELINE LEAK, EXPLOSION, FIRE
VARI	GRE	SEA OF CRETE, IRAKLION, CRETE	499	82	EXPLOSION HULL RUPTURE BROKE-IN-2 FOUNDER
ARTEMIS	GRE	SUEZ CANAL, KM 24, EGYPT	496	80	MACHINE STEERING PROB. AGROUND
AL BILAD	KUW	PORT, S.W. AFRICA, NIGERIA	490	76	COLLISION WITH SHIP AT SEA
ATHOS	FRE	EUROPORT TERM. ROTTERDAM, NETH.	490	87	ANCHORED COLLISN W/SHIP STRUCTR
CALIFORNIA GETTY	LIB	PORT IN PERSIAN GULF	490	80	NAVIGATING, STRUCTURAL DAMAGE
CLASSIC	GRE	RIVER, EAST GERMANY	490	77	NAVIGATING, AGROUND
EIKO MARU	JAP	NORTHEAST ASIA, OFF JAPAN	490	75	LOADING
ESSO KAGOSHIMA	LIB	INDIAN OCEAN, OFF SOUTH AFRICA	490	75	ERROR AT TERMINAL
EUROASIA MONARCH	SIN	PORT, GABON, SOUTHERN W. AFRICA	490	76	NAVIGATING, AGROUND
GEORGE S	GRE	500 MI N OF CAPE VERDE I.ATLANTIC O	490	81	NAVIGATING IN A STRAIT, FIRE
NIKOS M	GRE	GULF OF ADEN, DJIBOUTI WATERS	490	83	UNLOADING OVERFILLING ERROR
OTE MARU 15 (BARGE)	JAP	OFF JAPAN	490	75	STRUCTURAL DAMAGE
SANT AMBROGIO	ITA	PORT OR TERMINAL, NETHERLANDS	490	74	FIRE ABANDON
STUYVESANT	USA	GULF OF TEHUANTEPEC, MEXICO	490	81	SEVERE WEATHER, CRACKED CARGO TANK

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
MITSU MARU 3 (BARGE)	JAP	JAPAN	486	75	UNSPECIFIED
BRODENA (ERODONA)	BRI	PORT KAISER, JAMAICA	486	81	COLLISION WITH MALTESE TANKER FIONA
PHILLIPS OKLAHOMA	LIB	NEAR HULL, ENGLAND OUTSIDE HUMBER R	486	89	ANCHORED WEATHER AGROUND
TENSHO MARU (CARGO VES.)	JAP	OFF HONSHU, JAPAN	486	84	COLLISN
TANKER	UNS	SOUTHERN SUMATRA, INDONESIA	483	84	MACHINE VALVE MALFUNCTION
B.F.T. #24 (BARGE)	USA	SOUTH BOSTON HARBOR, MA	476	86	PERSONL? MACHINE? TANK OVERFLOW
GOLAR LIZ	LIB	SINGAPORE, NR STRAIT OF MALACCA	476	88	AGROUND
RHEINTANK 20	WGE	NEAR GINSHEIM-GUSTAVSBURG, GERMANY	470	89	AGROUND
MIYA MARU NO. 8	JAP	SAKAI, JAPAN	463	79	COLLISN
KINEI MARU	JAP	SETO NAKAI SEA, OFF KOBE, JAPAN	460	82	COLLISN W/SHIP
TT-7002 (BARGE)	USA	BEAUMONT, TEXAS	449	80	PERSONL LOADING OVERFLOW
MARITIME GARDENIA (MV)	LIB	WAKASA BAY, MAIZURU, HONSHU I.JAPAN	449	90	WEATHER AGROUND FOUNDER
OLYMPIC RIDER	LIB	NEAR KENYA	441	76	AGROUND
OLYMPIC GAMES	LIB	DELAWARE RIVER, PA	434	76	AGROUND STRUCTR HULL RUPT
GERHARD	WGE	10 KM OFF PORTLAND BILL, ENG.	431	83	WEATHER COLLISN TANK RUPTURE
MOBIL LUBCHEM	BRI		428	74	COLLISN
KASUGA-MARU #1	JAP	KYOTO PREF, OFF KYOGA CAPE, JAPAN	428	88	WEATHER LEAK LISTING
(BARGE)	UNS	HUDSON? R. NEAR NEWBURGH, NY	421	74	AGROUND STRUCTR HULL RUPT
IMPERIAL SARNIA	CAN	ST LAWRENCE SEAWAY, NY	415	74	AGROUND STRUCTUR HULL RUPT
EXXON BARGE 503	USA	GULF OF MEXICO OFF TAMPA,FL	409	88	WEATHER MANIFOLD RUPTURE COVER LOST
CZANTORIA	LIB	ST. ROMULAD, QUEBEC	408	88	TANK RUPTURE
SHAMROCK (BARGE)	USA	CHESAPEAKE BAY, MARYLAND	408	75	AGROUND
THEODEGMON	GRE	ORINOCO R, NEAR PUERTO ORDAZ, VENEZ	408	83	OTHER
MISSISSIPPI (BARGE)	USA	MI. 730.5 UPPER MISS. R. MINNESOTA	402	78	AGROUND STRUCTR HULL RUPT
TOKUYU MARU NO. 12	JAP	OFF KOBE, JAPAN	395	81	COLLISN
EXXON HOUSTON	USA	OFF SW PASS, MOUTH OF MISS. R.	389	89	COLLISION? AGROUND STRUCTR TANK RUPT
ST-85 (BARGE)	USA	BUZZARDS BAY, WEST FALMOUTH, MA	389	86	COLLISN CONTACT
AL FUNTAS	KUW	WILHELMSHAVEN, WEST GERMANY	384	74	COLLISION W/ SHIP
CIELO ROSSO	ITA	THE KATTEGAT, SWEDEN	383	79	AGROUND
OFFSHORE 2403	USA	CALIFORNIA?	380	84	NOT SPECIFIED
TANKER?	USA	RIVER NEAR CORPUS CHRISTI, TX	374	85	PERSONL MACHINE STRUCTR HULL RUPT
ETHEL H. (BARGE)	USA	PERTH AMBOY, NJ	373	80	PERSONL LOADING TANK OVERFLOW
SUFFOLK (BARGE)	USA	BAYONNE, NJ	373	80	COLLISN
GARBIS	LIB	STRAITS OF FLORIDA	367	75	DDISCHG
RICHMOND DREDGER	UNS	BRITISH COLUMBIA, CANADA	363	77	OTHER
MAKHANIK TARASOV	RUS	NORTH ATLANTIC O. OFF NEWFOUNDLAND	359	82	WEATHER LEAK LISTING
CHEM 13 (BARGE)	USA	MI 178.3 UPP. MISS. R. ST. LOUIS,MO	356	84	COLLISN AGROUND STRUCTR HULL RUPT
EIKO MARU NO. 1	JAP	OFF SHIOGAMA & KARAKUWAZAKI, JAPAN	356	83	WEATHER COLLISN W/ CARGO SHIP CAVALRY
CHOTIN 1451 (BARGE)	USA	GULF INTERCOASTAL WTRWY. MI 123, LA	354	85	MACHINE CONTACT STRUCTR TANK RUPT
MAR CASPIO	ARG	BUENOS AIRES, ARGENTINA	353	74	COLLISN
MORANIA 440 (BARGE)	USA	EAST RIVER, NY	351	89	AGROUND
THUNTANK 3	SWE	SAMSO ISL. GREAT BELT, DENMARK	351	79	AGROUND
AMAZON VENTURE	LIB	NEW YORK HARBOR UPPER BAY	343	86	VALVE FAILURE
GOLDEN PEACE 101 (BARGE)	UNS	OFF SARAWAK, E.MALAYSIA LUTONG MIRI	343	86	FOUNDER
INTERMAR ALLIANCE	LIB	MARCUS HOOK, PA--DELAWARE RIVER	340	86	AGROUND STRUCTR HULL RUPT
MESSINIAKI BERGEN	GRE	NEW HAVEN, CONNECTICUT	340	74	CONTACT W/PIER
AFRAN ZODIAC	LIB	BANTRY BAY, IRELAND	335	75	COLLISN W/SHIP
NAKATA ELEVEN	JAP	LOME, TOGO	334	80	COLLISN
PETER R. HEARNE (BARGE)	USA	WEST POINT, HUDSON RIVER, NY	330	87	AGROUND RUPT
BOUCHARD 115 (BARGE)	USA	EAST RIVER, NEW YORK CITY	330	75	AGROUND
EPTANISSOS	GRE	NEAR CARTEGENA, COLUMBIA	327	83	MACHINE HOSE BREAKUP DURING DISCHARGE
CHOTIN 2000 (BARGE)	USA	PADUCAH, KY OHIO RIVER MI. 972.3	324	81	AGROUND STRUCTR HULL RUPT
CHRISTIAN F. REINAUER	USA	METINIC ISLAND, MAINE	324	80	COLLISN STRUCTR HULL RUPT
CONCHO/BRADFORD ISLAND	USA	BROOKLYN, NY - NJ	324	81	AGROUND STRUCTR HULL RUPT
O.N. 535880 NO.105(BARGE)	USA	PERTH AMBOY, NEW JERSEY	324	77	AGROUND STRUCTR HULL RUPTURE
CIBRO SAVANNAH (BARGE)	USA	ARTHUR KILL R. NEAR LINDEN, NJ	324	90	EXPLOSION
POTOMAC	USA	GREENLAND	318	79	CONTACT
(U.S. NAVY TANKER)	UNS	WEST COAST OF GREENLAND	318	77	CONTACT
CHOTIN 2881& 2183X(BARGE)	USA	MISS. R., MI. 106, NEW ORLEANS, LA	301	90	COLLISION BETWEEN 2 SETS OF BARGES
FOLGOET	FRE	DONGES, ST. NAZAIRE, FRANCE	299	85	AGROUND
JAN	WGE	NE COAST, JUTLAND, DENMARK	299	85	LOADING
SOTKA	FIN	ALAND SEA W. OF ECKERO ISLAND	299	85	COLLISN STRUCTR
ARABIAN SEA	SAF	SAO SEBASTIAO, BRAZIL	298	83	STRUCTR HULL RUPT FOUNDER?
(BARGE)	UNS	KUSKOKWIM BAY, AK	298	82	
TIPOSO	LIB	11 MI N OF BERMUDA	295	83	AGROUND ABANDONED SCUTTLED
DELAWARE	USA	LONG ISLAND SOUND	292	75	COLLISN STRUCTR HULL RUPT
(BARGE)	UNS	ILLINOIS R. MI. 139.8, IL	285	74	COLLISN STRUCTR HULL RUPT
CBC 137 (BARGE)	UNS	OHIO RIVER MI. 184.3, OH	279	81	COLLISN STRUCTR HULL RUPT
ROLLNES	UNS	MOBILE, ALABAMA	275	78	CONTACT MACHINE
CHOTIN 3291 (BARGE)	USA	CARUTHERSVILLE, MISSOURI, MISS. R.	272	79	CONTACT
IMPERIAL ACADIA	CAN	OFF PORT AUX BASQUES, NEWFOUNDLAND	272	82	COLLISION FIRE
JOHN A. MCCONE	USA	LONG BEACH, CALIFORNIA	272	80	COLLISN STRUCTR HULL RUPT
J. R. GREY	LIB	BAY OF FUNDY, MAINE - NOVA SCOTIA	272	76	AGROUND STRUCTR HULL RUPT
ON 541952 (BARGE)	UNS	PORT ARTHUR, TEXAS	272	74	COLLISN STRUCTR HULL RUPT
PERA/ LORENZO HALCOUSSI	GRE	LOS ANGELES HARBOR, CA	272	75	COLLISN STRUCTR TANK RUPT
POINTE LEVY (BARGE)	UNS	MATANE, QUEBEC GULF OF ST. LAWRENCE	272	85	MACHINE
STCO-412 (BARGE)	USA	INTRACOAST WATERWAY-MORGAN CITY, L	272	90	COLLISN STRUCTR HULL RUPT
TEXACO ILLINOIS	UNS	WESTVILLE, NJ	272	76	AGROUND
TEXAS ON 523761 (BARGE)	USA	NEW ORLEANS, LA MISS. R. MI. 95.4	272	77	STRUCTR
TT 7001 (BARGE)	USA	ILLINOIS R. MI. 56.0 FLORENCE, ILL.	272	83	AGROUND

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
(BARGE)	UNS	YONKERS, NEW YORK	272	74	TANK RUPTURE
WGH NO. 16 (BARGE)	USA	OHIO RIVER MI. 491.0, OH	265	75	STRUCTR HULL RUPT
BARGE NO. 65	USA	OFF NEW BEDFORD, MA	263	77	AGROUND STRUCTR HULL RUPT
NEW YORK (BARGE)	USA	TAMPA, FLORIDA	262	77	CONTACT COLLISN STRUCTR HULL RUPT
AMERICAN LEGION	USA	ENTRANCE TO APRA HARBOR, GUAM	259	85	AGROUND STRUCTUR HULL RUPTURE
BAILEY	PA?	3.9K M OFF MIKOMOTOSHIMA, JAP.	259	83	COLLISN
KANSAS (BARGE)	USA	OHIO RIVER MI. 877.0, KY	259	78	COLLISN STRUCTR HULL RUPT
KAZIMIERZ PULASKI	POL	KILL VAN KULL R., BAYONNE, NJ	259	85	COLLISN STRUCTR HULL RUPTURE
MOBILE (BARGE)	USA	OHIO RIVER MI. 918.6, KY	259	80	AGROUND STRUCTUR HULL RUPTURE
REB 192 (BARGE)	USA	BERWICK, LA	259	79	COLLISN
AFRAN ZENITH	LIB	HAMBURG, WEST GERMANY	259	81	CONTACT W/BRIDGE AGROUND
TANK SHIP	UNS	TAMPA BAY, FLORIDA	257	84	UNDETERMINED
BARGE	UNS	CANADA, NW TERRITORIES, HAY R.	256	86	NEGLIGENCE
LITIOPIA	BRI	AMLWCH, WALES, UK	254	78	UNLOADING MACHINE HOSE RUPTURE
BARGE #45	USA	HUDSON, R. NEAR CATSKILL, NY	253	89	CONTACT WITH MARKER LIGHT
B. NO. 105 (BARGE)	USA	NEAR PERTH AMBOY, NY	253	79	AGROUND STRUCTR HULL RUPT
ENTERPRISE	BRI	AHMADI, KUWAIT	249	89	CONTACT DAMAGE TO BUNKER TANKS WHILE AT BERTH
HOSEI MARU	JAP	KESENNUMA, JAPAN	249	80	FOG COLLISN
NANCY ORR GAUCHER	LIB	HAMILTON HARBOR, ONTARIO, CANADA	249	89	UNLOADING TANK OVERFLOW
OVERSEAS JOYCE	USA	BALBOA CHANNEL, PANAMA	247	78	COLLISN
AMOCO YORKTOWN	LIB	TEXAS CITY, TEXAS	245	75	MACHINE
ACT-506 (BARGE)	USA	OFF DELAWARE VA?	243	77	WEATHER AGROUND STRUCTR BREAKUP
BLUE MAGPIE	PAN	YAQUINA BAY, NEAR NEWPORT, OREGON	243	83	COLLISION
LINDSEY FRANK	UNS	KILL VAN KULL R., NY NR STATEN I.	243	86	COLLISN
(BARGE)	UNS	OHIO RIVER MI. 604.2, KY	243	77	AGROUND STRUCTR HULL RUPT
(BARGE)	UNS	OHIO RIVER MI. 469.6, OH	239	74	COLLISN STRUCTR HULL RUPT
TINE	GRE	HALLSKOV, GREAT BELT, DENMARK	236	79	STRUCTR AGROUND
ROLLNER (MV)	UNS	USA	233	78	UNSPECIFIED
TURGUT REIS	TUR	105 MI (170 KM) N LA CORUNA, SPAIN	233	79	WEATHER HULL RUPT
INGEBORG	UNS	NORTH SEA	233	74	OTHER
M-600 (BARGE)	USA	NEW ORLEANS, LA MISS. R. MI. 107.0	231	79	STRUCT CRACK IN HULL
THOMPSON PASS	USA	PORT VALDEZ, AK	231	89	COLLISN STRUCTR HULL RUPT
TRADE NOMAD	GRE	WHITE CASTLE, LA MISS. R. MI. 199.0	231	79	COLLISN STRUCTR TANK RUPT
ATLANTIC MARQUESS	LIB	LOWER MISSISSIPPI RIVER	229	77	CONTACT
(TANK SHIP)	UNS	TENNESSEE R., TN	229	79	COLLISN
RIO IQUAZU	UNS	ORESUND SOUND, SWEDEN/DENMARK	228	75	UNSPECIFIED
ZAMORA	ECU	MOBILE HARBOR, ALABAMA	228	79	OTHER
ARYADOOT	IND	GIBRALTAR	224	76	WEATHER
NEW YORK (BARGE)	USA	PORT LAUDERDALE, FLORIDA	224	80	AGROUND STRUCTR TANK RUPTURE
NITTAN MARU 3	JAP	UBE, JAPAN	221	80	WEATHER COLLISN
BARGE #570	USA	BEAUFORT SEA NEAR PRUDHOE BAY, AK	220	88	AGROUND HULL RUPTURE
CAPTAIN BRISCOE (BARGE)	UNS	OHIO R. MI. 787.0, KY	218	79	COLLISN STRUCTR HULL RUPT
CHOTIN 2546 (BARGE)	USA	MOBILE BAY, ALABAMA	218	78	COLLISN STRUCTR TANK RUPT
GULFOIL	USA	PORT ARTHUR, TEXAS	218	79	COLLISN STRUCTR HULL RUPT
B-117 (BARGE)	USA	LOWER MISSISSIPPI R. MI. 435.8, MS	218	75	CONTACT HULL PUNCTURE ON PILING
BETTENDORF (BARGE)	USA	MI. 363.7 UPP. MISSISSIPPI R., IA	218	84	COLLISN STRUCTR HULL RUPT
MCN OIL BARGE #5	USA	SHANNON POINT, PUGET SOUND, WA	217	88	CAPSIZE FOUNDER
KISARAGI MARU NO. 3	UNS	SEA OF JAPAN	215	75	AGROUND
TOLMIROS (SUSPECTED)	UNS	NNE GOTHENBURG, SWEDEN KATTEGET	214	87	TANK CLEANING
BETTY (BARGE)	USA	ARKANSAS R. MI. 116.0, AR	207	79	STRUCTR
NETTE THERESA	DAN	LITTLE BELT, DENMARK	205	79	DDISCHG
CHOTIN 1601 (BARGE)	USA	MILE 858, LOWER MISS. RIVER, MO	204	81	AGROUND
DELAWARE (BARGE)	USA	HOUMA, LA INTERCOAST. WTWY. MI. 55	204	77	COLLISN
FLAMMULINA	USA	CARTERET & ARTHUR KILL, NJ	204	84	PERSONL TANK OVERFLOW
ST. THOMAS (BARGE)	USA	CROWN BAY, ST. THOMAS, VIRGIN ISL.	204	86	COLLISN STRUCTR TANK RUPT
TS-86 (85?) (BARGE)	USA	LOWER MISSISSIPPI R. MI. 87.0, LA	204	75	COLLISN STRUCTR TANK RUPT
(BARGE)	UNS	MI 88.3 MISSISSIPPI RIVER	204	74	STRUCT FAILURE AGROUND
FURENAS	SWE	ORESUND STRAIT, DEN/SWE	201	80	OFFLOADING
WORLD GALA	LIB	SAO SEBASTIAO, BRAZIL	201	81	COLLISN
MOBIL 322 (BARGE)	USA	THEBES, IL UPPER MISS. R. MI. 43.7	200	79	CONTACT COLLISN STRUCTR HULL RUPT
BRADIA (BRADY) MARIA	PAN	RIVER ELBE S. OF KIEL CANAL ENTRANC	199	86	WEATHER AGROUND
THUNTANK 5	SWE	GULF OF BOTHNIA NR GAVLE HARB SWEDE	199	86	COLLISN STRUCTR
REB 901 (BARGE)	USA	MILE 24 OHIO RIVER	198	84	UNSPECIFIED
BRIDGENESS	BRI	IRISH SEA-17 MI PEMBROKESHORE,WALES	196	85	AGROUND
BROLAND	BRI	PORT READING, NEW JERSEY	194	78	CONTACT AGROUND STRUCTR TANK RUPT
HAEKWANG NO. 1	KOR	YOSU, SOUTH KOREA	191	84	AGROUND
STOLT AVANCE	LIB	STR. OF MALACCA, SINGAPORE	191	87	AGROUND
SULLY (BARGE)	USA	GIBSON, LA	190	76	EXPLOSN FIRE STRUCTR HULL RUPT
THEOGENNITOR	CYP	SINES TERM., S. OF LISBON, PORTUGAL	188	90	UNLOADING PERSONNEL ERROR
FRANK H. BROWN	CAN	ON BURNT ISLAND REEF, WRANGELL, AK	186	90	AGROUND ON REEF RUPTURED STORAGE TANK
PUERTO RICAN	USA	SABINE/NECHES INT. LA	184	79	COLLISN
IMPERIAL BEDFORD	UNS	NOVA SCOTIA, CANADA	181	77	MACHINE
ISOMERIA	FRE	ARABIAN GULF, KUWAIT	181	74	OTHER
TOSA MARU	UNS	ARABIAN GULF	181	74	OTHER
CABO PILAR-CHILENA	CHI	QUINTERO, CHILE	178	87	TANK LEAK
(BARGE)	UNS	INTRACOASTAL WATERWAY, LA	177	80	STRUCTR HULL RUPTURE
ONDINA	HOL	HARBOR AT HAMBURG, WEST GERMANY	177	82	VALVE
PETROS HADJIKYRIKOS	GRE	THAMES ESTUARY, UK	176	77	DDISCHG
THEOPASS	GRE	290 KM SW OF SAN JUAN, PR	176	78	OTHER
YANXILAS	GRE	GREAT BELT, DENMARK	176	79	AGROUND

APPENDIX B MMS TANKER SPILLS IN ORDER OF SPILL SIZE

NAME	FLAG	LOCATION	APPROXIMATE SPILL SIZE (Tonnes)	YEAR	TYPE OF CASUALTY
(AMOCO TANKER)	UNS	NORTH SEA OFF IRELAND	176	77	COLLISN LEAKAGE
GOLDEN EAGLE	UNS	NEWFOUNDLAND, CANADA	175	77	WEATHER STRUCTR
(TANK SHIP)	UNS	LOWER MISSISSIPPI R. MI. 88.0, LA	174	82	STRUCTR HULL RUPT
BUTE NO. 3 (BARGE)	CAN	GRAHAM I., BRITISH COLUMBIA	172	84	AGROUND
GOLAR PETROTRADE	LIB	ROTTERDAM, THE NETHERLANDS	165	85	PERSONL error
BAYOU WILLOW (BARGE)	UNS	GALVESTON BAY, TEXAS	163	78	COLLISN STRUCTR HULL RUPT
(TANK SHIP)	UNS	NEAR CORPUS CHRISTI, TX	163	83	COLLISN STRUCTR TANK RUPT
FERNANDO	UNS	MANILA BAY, BATAAN PEN.,PHILIPPINES	162	90	LEAK WHILE LOADING
JORGEN J. LORENTZEN	SWE	GOM, 30 MILES SOUTH OF CAMERON, LA	162	86	AGROUND STRUCTR HULL RUPT
ROBERT L. POLING (BARGE)	USA	GRAVESEND BAY, NY	162	78	COLLISN STRUCTR HULL RUPT
TURPIAL	VEN	HOUSTON SHIP CHANNEL, TEXAS	162	84	STRUCTR HULL RUPT
(TANK SHIP)	UNS	CAPE FEAR RIVER MI. 25.0, NC	162	82	PERSONL IMPROPER WASTE DISPOSAL
AMOCO CREMONA	LIB	TEXAS CITY, TEXAS	155	79	CONTACT COLLISN STRUCTR TANK RUPT
CHASTINE MAERSK	DAN	KUWAIT, KUWAIT	149	79	AGROUND
EKPORS	SWE	BALTIC SEA OFF AHUS, SWEDEN	149	78	PERSONNL TANK WASHING
METON	USA	OFF VA	149	81	COLLISN
NORDIC CLANSMAN	BRI	C. D'ANTIFER, FRANCE	149	78	PERSONL
TOTTSVILLE	UNS	NEW YORK	146	74	UNSPECIFIED
(BARGE)	USA	MI 22.5 ARKANSAS RIVER, ARKANSAS	146	84	AGROUND STRUCTR HULL RUPTURE
CIBRO PHILADELPHIA(BARGE)	UNS	NEW YORK HARBOR, NY	144	78	AGROUND STRUCTR HULL RUPT
(UNKNOWN)	UNS	OCEAN CITY, MD	144	77	DDISCHG
TEXACO 803 (BARGE)	USA	BAYONNE, NEW JERSEY	143	85	PERSONL TANK OVERFLOW
KIRISHIMA MARU NO. 11	JAP	550 METERS OFF YOKOHAMA, JAPAN	139	83	COLLISN
AO-S247,C245,375 (BARGE?)	USA	MI. 472 OHIO RIVER	137	89	WEATHER COLLISION 2 TANK RUPTURES, 1 HULLRUPT
2 BARGES	USA	SABINE R., NEAR ORANGE, TEXAS	136	85	CONTACT COLLISN STRUCTR HULL RUPT
APT 150 (BARGE)	USA	PASCAGOULA, MISSISSIPPI	136	82	CONTACT STRUCTR TANK RUPT
CIBRO PHILADELPHIA (BARGE	USA	1 MI N. OF VERRAZANNO NARROWS BR.NY	136	80	COLLISION W/BARGES WHILE DOCKED RUPT TANK
CROWLEY MARIT.101 (BARGE)	USA	SAN FRANCISCO BAY, CA	136	79	AGROUND STRUCTR HULL RUPT
HANA (BARGE)	USA	HONOLULU BTW OAHU & MOLOKAI, HAWAII	136	87	WEATHER CAPSIZE FOUNDER
HOLLYWOOD 2006 (BARGE)	USA	MILE 110 ATCHAFOLAYA RIVER, LA	136	85	COLLISN STRUCT HULL RUPT
IRVING ESKIMO	UNS	ST. LAWRENCE RIVER, NR QUEBEC	136	83	EXPLOSION FIRE
MARY (BARGE)	USA	NEW ORLEANS, LA MISS. R. MI. 118.6	136	78	COLLISN TANK RUPTURE
PETER MAERSK	DAN	CAPE FEAR RIVER, NC	136	83	RUPTURE
SKYRON	LIB	NORTH SEA, STR. OF DOVER, UK	136	87	WEATHER COLLISION W/HEL(CV) FIRE
STCO 225 (BARGE)	USA	NEAR BEAUMONT, TX	136	76	COLLISN
STCO-213 (BARGE)	USA	GALVESTON BAY, TEXAS	136	77	COLLISN BTW BARGES STRUCTR HULL RUPTURE
STOLT SEA	LIB	ON MISSISSIPPI R. IN AVONDALE, LA	136	88	WEATHER COLLISN STRUCTR HULL RUPT
(BARGE)	USA	ALVIN, TEXAS	136	80	WEATHER STRUCTR EQUIP FAILURE IMP. SECURING
(BARGE)	UNS	SALVADOR, BRAZIL	136	80	MOVEMENT OF TUGBOAT WHILE BARGE ANCHORED

APPENDIX C

MMS TANKER SPILLS
OVER 5000 TONNES

11-Mar-92

Spills over 5000 Tonnes

	DAY	MONTH	YEAR	VESSEL						SPILL						LOCATION				
				NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	MAR	PLACE
1	[illegible]	[illegible]	[illegible]	SEA SPRAY	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	NORTH SOUTHEAST ASIA
2	[illegible]	[illegible]	[illegible]	SEA SPIRIT	T	[illegible]	0	0	0	UNSP	[illegible]	[illegible]	[illegible]	1	CRUDE	T	34:00N	118:15W	120	LOS ANGELES HARBOR, CA
3	[illegible]	[illegible]	[illegible]	THEODOROS V	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	74	MID-ATL., 400M N OF DAKAR, SENEGAL
4	[illegible]	[illegible]	[illegible]	(BARGE)	B	[illegible]	0	0	0	UNSP	[illegible]	[illegible]	[illegible]	0	UNSPECIFIED	T	[illegible]	[illegible]	81	MI 116 MISSISSIPPI RIVER
5	[illegible]	[illegible]	[illegible]	METULA	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	LIGHT ARABIAN CRUDE	F	[illegible]	[illegible]	[illegible]	SATTELITE BANK, MAGELLAN STR, CHILE
6	[illegible]	[illegible]	[illegible]	ESSO GARDEN STATE	T	[illegible]	0	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	PORT OR TERMINAL, BRAZIL
7	[illegible]	[illegible]	[illegible]	ELEFTHERIA	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	LUBRICANTS	F	[illegible]	[illegible]	2	ATLANTIC O.-SIERRA LEONE, W. AFRICA
8	[illegible]	[illegible]	[illegible]	TROJAN	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	UNSP	UNSP	[illegible]	PACIFIC O./CHINA SEAS-PHILLIPINES
9	[illegible]	[illegible]	[illegible]	YUYO MARU 10	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	NAPHTHA	F	[illegible]	[illegible]	131	TOKYO BAY, JAPAN
10	[illegible]	[illegible]	[illegible]	CHERRY VINSTRA	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	102	ARABIAN SEA, GULF OF OMAN
11	[illegible]	[illegible]	[illegible]	SHOWA MARU	T	[illegible]	[illegible]	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	25	STRAIT OF MALACCA
12	[illegible]	[illegible]	[illegible]	MASTER STATHIOS	T	[illegible]	[illegible]	[illegible]	[illegible]	PARTIAL	[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	[illegible]	[illegible]	440	30 MI. DURBAN, S AFRICAN INDIAN O
13	[illegible]	[illegible]	[illegible]	BRITISH AMBASSADOR	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	65	180 MI. W. OF IWO JIMA I, PACIFIC
14	[illegible]	[illegible]	[illegible]	OSWEGO PATRIOT	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	T	[illegible]	[illegible]	121	MID N. PACIFIC OFF LOS ANGELES, CA
15	[illegible]	[illegible]	[illegible]	JAKOB MAERSK	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	IRANIAN CRUDE	F	[illegible]	[illegible]	145	PORT LEIXOES, N. PORTUGAL
16	[illegible]	[illegible]	[illegible]	TARIK IBN ZIYAD	T	[illegible]	[illegible]	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	376	RIO DE JANEIRO, BRAZIL
17	[illegible]	[illegible]	[illegible]	SPARTAN LADY	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	NO. 6 FUEL	T	[illegible]	[illegible]	116	12-200 MI. OFF NEW JERSEY
18	[illegible]	[illegible]	[illegible]	EPIC COLOCOTRONIS	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	VENEZUELAN CRUDE	F	[illegible]	[illegible]	43	CARIBBEAN, 60 MI. NW OF PUERTO RICO
19	[illegible]	[illegible]	[illegible]	PRINCESS ANNE-MARIE	T	[illegible]	[illegible]	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	BASRAH CRUDE	F	[illegible]	[illegible]	397	BARROW ISLAND, AUSTRALIA
20	[illegible]	[illegible]	[illegible]	THORSHAMMER	T	[illegible]	0	0	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	0	UNSPECIFIED	F	[illegible]	[illegible]	[illegible]	KUWAIT
21	[illegible]	[illegible]	[illegible]	OLYMPIC ALLIANCE	T	[illegible]	[illegible]	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	236	ENGLISH CHANNEL, UK
22	[illegible]	[illegible]	[illegible]	SAINT PETER	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	COLOMBIAN CRUDE	F	[illegible]	[illegible]	0	30 MI W OF PUNTA [illegible], COLOMBIA
23	[illegible]	[illegible]	[illegible]	NANYANG	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	97	S. CHINA SEA, 40 MI E OF HONG KONG
24	[illegible]	[illegible]	[illegible]	SCORPIO	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	46	GULF OF CAMPECHE, 11 MI FR PORT, MEX
25	[illegible]	[illegible]	[illegible]	ELLEN CONWAY	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	LIBYAN CRUDE	F	[illegible]	[illegible]	[illegible]	MED. SEA, OUTER HARB ARZEW, ALGERIA
26	[illegible]	[illegible]	[illegible]	URQUIOLA	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	KUWAIT CRUDE	F	[illegible]	[illegible]	145	LACORUNA, SPAIN
27	[illegible]	[illegible]	[illegible]	AL DAMMAM	T	[illegible]	[illegible]	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	MEDITERRANEAN, [illegible]
28	[illegible]	[illegible]	[illegible]	BRAZILIAN FAITH	T	[illegible]	[illegible]	0	0	UNSP	[illegible]	[illegible]	[illegible]	0	UNSPECIFIED	F	[illegible]	[illegible]	25	STRAIT OF MALACCA
29	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	0	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	25	STRAIT OF MALACCA, MALAYSIA
30	[illegible]	[illegible]	[illegible]	CRETAN STAR	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CHINESE/ARAB CRUDE	F	[illegible]	[illegible]	29	450 MI OFF BOMBAY, INDIA
31	[illegible]	[illegible]	[illegible]	[illegible] PETROCHEM	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	UNSP	UNSP	81	GULF OF MEXICO, LOUISIANA
32	[illegible]	[illegible]	[illegible]	BOHLEN	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	145	55 KM OFF BREST, FRANCE
33	[illegible]	[illegible]	[illegible]	ARGO MERCHANT	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	NO. 6 FUEL/NAPTHA	F	[illegible]	[illegible]	151	45 KM SE OF NANTUCKET, MA
34	[illegible]	[illegible]	[illegible]	GRAND ZENITH	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	NO. 6 FUEL OIL	F	[illegible]	[illegible]	150	ATLANTIC O., MASSACHUSETTS
35	[illegible]	[illegible]	[illegible]	IRENES CHALLENGE	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	HEAVY VENEZ. CRUDE	F	[illegible]	[illegible]	[illegible]	200 MI (320 KM SE) OF MIDWAY ISLAND
36	[illegible]	[illegible]	[illegible]	BORAG	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	[illegible]	[illegible]	[illegible]	REEF 4 KM OFF TAIWAN (NE. YEH-LIU)
37	[illegible]	[illegible]	[illegible]	HAWAIIAN PATRIOT	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	INDONESIAN CRUDE	F	[illegible]	[illegible]	[illegible]	320 MI W OF HAWAII (KAUAI I.)
38	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	2	NAPHTHA	F	UNSP	UNSP	30	MID-NORTHERN INDIAN OCEAN
39	[illegible]	[illegible]	[illegible]	CARIBBEAN SEA	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	VENEZUELAN CRUDE	F	[illegible]	[illegible]	43	S. OF EL SALVADOR CENTRAL AMER.
40	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	2	ASPHALT	F	UNSP	UNSP	43	CARIBBEAN, NETHERLANDS ANTILLES
41	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	[illegible]	0	0		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	RIVER NEAR BLACK SEA, BOSPHORUS
42	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	[illegible]	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	131	40 MILES OFF JAPAN
43	[illegible]	[illegible]	[illegible]	AL-RAWDATAIN	T	[illegible]	[illegible]	0	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	KUWAIT CRUDE	F	[illegible]	[illegible]	[illegible]	GENOA, ITALY
44	[illegible]	[illegible]	[illegible]	MATSUSHIMA MARU NO.3	T	[illegible]	[illegible]	[illegible]	[illegible]	BALLAST	[illegible]	[illegible]	[illegible]	2	LUBRICANTS	F	[illegible]	[illegible]	131	30 MI. SSE OF MUROTO MISAKI, JAPAN
45	[illegible]	[illegible]	[illegible]	VENOIL	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	IRANIAN CRUDE	F	[illegible]	[illegible]	441	32 KM OFF SOUTH AFRICA
46	[illegible]	[illegible]	[illegible]	BRAZILIAN MARINA	T	[illegible]	[illegible]	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	376	SAO SEBASTIAO, BRAZIL
47	[illegible]	[illegible]	[illegible]	JAPAN [illegible]	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	PERSIAN GULF
48	[illegible]	[illegible]	[illegible]	IKUYO MARU	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	PERSIAN GULF
49	[illegible]	[illegible]	[illegible]	AMOCO CADIZ	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	LIGHT ARABIAN CRUDE	F	[illegible]	[illegible]	145	OFF PORTSALL, BRITTANY WEST FRANCE
50	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	GASOLINE	F	[illegible]	[illegible]	[illegible]	ATLANTIC O., BANCO DO MEIO, BRAZIL
51	[illegible]	[illegible]	[illegible]	CABO TAMAR	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	415	SAN VICENTE BAY, CHILE
52	[illegible]	[illegible]	[illegible]	LIMA	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	PORT, S.W. AFRICA, NIGERIA
53	[illegible]	[illegible]	[illegible]	MARA	T	[illegible]	[illegible]	[illegible]	[illegible]	PARTIAL	[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	[illegible]	[illegible]	43	CARIBBEAN, 5 MI CURACAO, NETHERLANDS
54	[illegible]	[illegible]	[illegible]	TADOTSU	T	[illegible]	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	GULF OF OMAN
55	[illegible]	[illegible]	[illegible]	KOSMAS M	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	[illegible]	[illegible]	[illegible]	AKBAS NR. CANAKKALE DARDANELLES, TURK
56	[illegible]	[illegible]	[illegible]	ANDROS PATRIA	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	IRANIAN CRUDE	F	[illegible]	[illegible]	145	BAY OF BISCAY/CAPE FINISTERRE, SPAIN
57	[illegible]	[illegible]	[illegible]	MASTER MICHAEL	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	DIESEL FUEL	F	[illegible]	[illegible]	44	CARIBBEAN SEA BTW HAITI-VENEZ.
58	[illegible]	[illegible]	[illegible]	BETELGEUSE	T	[illegible]	[illegible]	[illegible]	[illegible]	PARTIAL	[illegible]	[illegible]	[illegible]	1	LIGHT ARABIAN CRUDE	F	[illegible]	[illegible]	101	BANTRY BAY, IRELAND
59	[illegible]	[illegible]	[illegible]	SIMONBURN	T	[illegible]	[illegible]	0	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	NO. 6 FUEL	F	[illegible]	[illegible]	[illegible]	65 KM NE OF SYDNEY, NOVA SCO.
60	[illegible]	[illegible]	[illegible]	MESSINIAKI FRONTIS	T	[illegible]	[illegible]	0	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	LIBYAN CRUDE	F	[illegible]	[illegible]	142	2 KM OFF CRETE KALOI LIMENES
61	[illegible]	[illegible]	[illegible]	KURDISTAN	T	[illegible]	[illegible]	0	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	2	BUNKER C/NAPTHA	F	[illegible]	[illegible]	150	CABOT STRAIT, N. SCOTIA, CANADA
62	[illegible]	[illegible]	[illegible]	FORTUNE	T	[illegible]	[illegible]	0	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	KUWAIT CRUDE	F	[illegible]	[illegible]	25	88 KM NE OF SINGAPORE
63	[illegible]	[illegible]	[illegible]	GINO	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	CARBON BLACK FEEDSTK	F	[illegible]	[illegible]	145	40 MI. OFF COAST OF BRITTANY, FRANCE
64	[illegible]	[illegible]	[illegible]	VERA BERLINGIERI	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	GASOLINE DIESEL FUEL	F	[illegible]	[illegible]	179	18 MI (30 KM) OFF FIUMICINO, ITALY
65	[illegible]	[illegible]	[illegible]	AVILES	T	[illegible]	0	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	KEROSENE JET FUEL	F	[illegible]	[illegible]	[illegible]	280 MI. NW COCHIN, ARABIAN SEA, INDIA
66	[illegible]	[illegible]	[illegible]	ATLANTIC EMPRESS	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	ARABIAN CRUDE	F	[illegible]	[illegible]	42	30 KM NE TRINIDAD-TOBAGO
67	[illegible]	[illegible]	[illegible]	AEGEAN CAPTAIN	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	VENEZUELAN CRUDE	F	[illegible]	[illegible]	42	30 KM NE TRINIDAD-TOBAGO
68	[illegible]	[illegible]	[illegible]	ATLANTIC EMPRESS	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	ARABIAN CRUDE	F	[illegible]	[illegible]	42	450KM EAST OF BARBADOS
69	[illegible]	[illegible]	[illegible]	IOANNIS ANGELICOUSSIS	T	[illegible]	[illegible]	[illegible]	[illegible]	PARTIAL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	334	CABINDA GULF OIL, MALONGO, ANGOLA
70	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	[illegible]	0	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	2	DIESEL FUEL	F	[illegible]	[illegible]	[illegible]	TOMANAUS ROADS, BRAZIL
71	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	43	OFF ISLA DE MARGARITA, VENEZUELA

Spills over 5000 Tonnes

				VESSEL						SPILL						LOCATION				
	DAY	MONTH	YEAR	NAME	TYPE	FLAG	DWT	GRT	BUILT	LEVEL	AMOUNT TONNES	LOW TONNES	HIGH TONNES	TYPE	OIL	US	LAT	LONG	[illegible]	PLACE
[illegible]	[illegible]	[illegible]	[illegible]	GUNNOR MAERSK	T	DEN	[illegible]	[illegible]	[illegible]	PARTIAL	[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	[illegible]	[illegible]	[illegible]	AMAZON R., MANAUS ROADS, BRAZIL
[illegible]	[illegible]	11	[illegible]	BURMAH AGATE	T	LIB	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	NIGERIAN LIGHT CRUDE	T	[illegible]	[illegible]	82	4 MI. FR ENTR. GALVESTON BAY, TEXAS
[illegible]	[illegible]	11	[illegible]	INDEPENDENTA	T	RUM	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	LIBYAN CRUDE	F	[illegible]	[illegible]	178	BOSPORUS STRAIT, ISTANBUL, TURKEY
[illegible]	[illegible]	[illegible]	[illegible]	SALEM (DELIBERATELY SUNK)	T	LIB	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	KUWAIT CRUDE	F	[illegible]	[illegible]	[illegible]	ATLANTIC O. S OF GAMBIA, W. AFRICA
[illegible]	[illegible]	[illegible]	[illegible]	IRENES SERENADE	T	GRE	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	LIBYAN CRUDE	F	[illegible]	[illegible]	142	NAVARINO BAY, OFF PILOS, GREECE
[illegible]	[illegible]	[illegible]	[illegible]	TANIO	T	PAN	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	HIGH SULFUR FUEL OIL	F	[illegible]	[illegible]	145	40 KM OFF BRITTANY, FRANCE
[illegible]	[illegible]	[illegible]	[illegible]	ZAVETTY ILYICHA	T	RUS	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	INDIAN OCEAN
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	T	[illegible]	0	[illegible]	[illegible]	UNSP	[illegible]	[illegible]	[illegible]	2	FUEL OIL/BUNKERS	F	[illegible]	[illegible]	[illegible]	400 KM ESE OKINAWA, JAPAN
[illegible]	[illegible]	[illegible]	[illegible]	FORTUNE	T	LIB	[illegible]	0	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	KUWAIT CRUDE	F	[illegible]	[illegible]	[illegible]	W OF DUBAI, UTD. ARAB EMIRATES
[illegible]	[illegible]	[illegible]	[illegible]	JUAN A. LAVALLEJA	T	URU	[illegible]	0	0	UNSP	[illegible]	[illegible]	[illegible]	2	CONDENSATE	F	[illegible]	[illegible]	[illegible]	OFF ARZEW, ALGERIA
[illegible]	[illegible]	[illegible]	[illegible]	CAVO CAMBANOS	T	GRE	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	NAPHTHA	F	[illegible]	[illegible]	[illegible]	TARRAGONA ROADS, OFF CORSICA
[illegible]	[illegible]	[illegible]	[illegible]	GOLDEN ACE	T	KOR	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	SOLID RESIDUE & COKE	F	[illegible]	[illegible]	23	S. CHINA SEA NEAR BORNEO
[illegible]	[illegible]	10	[illegible]	GLOBE ASIMI	T	GIB	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	HEAVY FUEL OIL	F	[illegible]	[illegible]	214	BALTIC PORT, KLAIPEDA, LITHUANIA, USSR
[illegible]	[illegible]	11	[illegible]	[illegible]	T	LIB	[illegible]	[illegible]	[illegible]	PARTIAL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	[illegible]	RAS GHARIB, GULF OF SUEZ
[illegible]	[illegible]	[illegible]	[illegible]	ASSIMI	T	GRE	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	IRANIAN CRUDE	F	[illegible]	[illegible]	[illegible]	RAS AL HADD, 18 MI. FROM MUSCAT
[illegible]	[illegible]	[illegible]	[illegible]	CASTILLO DE BELLVER	T	SPA	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	ARABIAN CRUDE	F	[illegible]	[illegible]	442	75 KM S. AFRICA, NW CAPE TOWN
[illegible]	[illegible]	[illegible]	[illegible]	SIVAND	T	IRA	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	LIGHT CRUDE	F	[illegible]	[illegible]	181	IMMINGHAM, ENGLAND
[illegible]	[illegible]	11	[illegible]	PNOC BASILAN	T	PHI	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	KEROSENE & GASOLINE	F	[illegible]	[illegible]	[illegible]	S CHINA SEA OFF AGOO, PHILLIPINES
[illegible]	[illegible]	[illegible]	[illegible]	PERICLES G.C.	T	GRE	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	LIGHT ARABIAN CRUDE	F	[illegible]	[illegible]	[illegible]	ARABIAN GULF, 200 MI ENE DOHA QATAR
[illegible]	[illegible]	[illegible]	[illegible]	ALVENUS	T	BRU	[illegible]	0	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	MEREY & PILON CRUDE	T	[illegible]	[illegible]	82	18 KILOMETERS SOUTH OF CAMERON, LA
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	T	IND	[illegible]	[illegible]	[illegible]	PARTIAL	[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	[illegible]	BUTCHER I. OIL TERM., BOMBAY, INDIA
[illegible]	[illegible]	[illegible]	[illegible]	PETRAGEN ONE	T	PAN	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	2	BUNKERS/NAPTHA	F	[illegible]	[illegible]	[illegible]	ALGECIRAS, SPAIN
[illegible]	[illegible]	[illegible]	[illegible]	NOVA	T	LIB	[illegible]	[illegible]	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	IRANIAN LIGHT CRUDE	F	[illegible]	[illegible]	[illegible]	140KM S OF KHARG IS ARAB. GULF
[illegible]	[illegible]	[illegible]	[illegible]	SOUTHERN CROSS	T	BAH	[illegible]	[illegible]	[illegible]	PARTIAL	[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	UNSP	UNSP	144	MEDITERRANEAN, ALGERIAN PORT SKIKDA
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	T	JAP	[illegible]	0	[illegible]	FULL	[illegible]	0	[illegible]	2	KEROSENE	F	[illegible]	[illegible]	[illegible]	SEINE R., NR LE HAVRE, FRANCE
[illegible]	[illegible]	[illegible]	[illegible]	ATHENIAN VENTURE	T	CYP	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	2	UNLEADED GAS/BUNKERS	F	[illegible]	[illegible]	140	350-400 MI. SE OF CAPE RACE, NEWFD.
[illegible]	[illegible]	[illegible]	[illegible]	CENTURY DAWN	T	PAN	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	[illegible]	[illegible]	28	PORT, SINGAPORE WATERS
[illegible]	[illegible]	11	[illegible]	ODYSSEY	T	LIB	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	NORTH SEA CRUDE	F	[illegible]	[illegible]	[illegible]	700 MI. NE OF ST JOHNS, NEWFOUNDLAND
[illegible]	[illegible]	[illegible]	[illegible]	EXXON VALDEZ	T	USA	[illegible]	0	[illegible]	FULL	[illegible]	[illegible]	[illegible]	1	NORTH SLOPE CRUDE	T	[illegible]	[illegible]	231	BLIGH REEF, P. WILLIAM S. VALDEZ AK
[illegible]	[illegible]	[illegible]	[illegible]	KANCHENJUNGA	T	IND	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	IRAQI LIGHT CRUDE	F	[illegible]	[illegible]	[illegible]	JEDDAH, SAUDI ARABIA 6 MI. FROM PORT
[illegible]	[illegible]	[illegible]	[illegible]	PUPPY P	T	MAL	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	2	FUEL OIL	F	UNSP	UNSP	[illegible]	MID-N. INDIAN OCEAN, INDIA
[illegible]	[illegible]	[illegible]	[illegible]	MARAO	T	POR	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	PORTUGUESE ATLANTIC
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	T	PAN	0	0	0		[illegible]	[illegible]	[illegible]	1	CRUDE	F	UNSP	UNSP	0	PHILLIPINE WATERS, NORTH ILLANA
[illegible]	[illegible]	[illegible]	[illegible]	PACIFICO	T	CYP	[illegible]	0	[illegible]		[illegible]	[illegible]	[illegible]	1	LIGHT BASRAH CRUDE	F	[illegible]	[illegible]	441	50-55 MI OFF EAST LONDON, S AFRICA
[illegible]	[illegible]	[illegible]	[illegible]	KHARK 5	T	IRA	[illegible]	0	0		[illegible]	[illegible]	[illegible]	1	HEAVY IRANIAN CRUDE	F	[illegible]	[illegible]	[illegible]	100 MI. OFF COAST OF MOROCCO - ATLANT
[illegible]	[illegible]	[illegible]	[illegible]	ARAGON	T	SPA	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	1	PEMEX MAYA CRUDE	F	[illegible]	[illegible]	118	N. ATLANTIC NE OF ISLAND OF MADEIRA
[illegible]	[illegible]	[illegible]	[illegible]	MEGA BORG	T	NOR	0	0	0		[illegible]	[illegible]	[illegible]	1	PALANCA ANGOLA CRUDE	T	[illegible]	[illegible]	0	60 MILES OFF GALVESTON, TEXAS

Spills over 5000 Tonnes

	LOCATION		CASUALTIES				REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
1	[illegible]	[illegible]	NAVIGATING, AGROUND	0			
2	HARB	[illegible]	UNSPECIFIED	0			WIS
3	OPEN	[illegible]	HIGH SEAS, EXPLOSION FIRE FOUNDER	0			LLP-[illegible]
4	HARB	[illegible]	UNSPECIFIED	0			WIS
5	HARB	[illegible]	FIRE [illegible] AGROUND HULL RUPT WEATHER ABANDON	0	DEAD PENGUINS, SEABIRDS	HEAVY POLLUTION [illegible] SQ MI WATER & COASTLINE	WIS MAR LLP-[illegible]
6	PIER	[illegible]	UNLOADING OVERFILLING BARGE	0			
7	[illegible]	[illegible]	EXPLOSION FIRE FOUNDER	0			LLP-[illegible]
8	[illegible]	[illegible]	LEAK OR FLOODING	0			
9	[illegible]	[illegible]	COLLISION W/SHIP FIRE EXPLOSION SCUTTLED	[illegible]			LLP-[illegible]
10	[illegible]	[illegible]	NAVIGATING, EXPLOSION AND FIRE	0			LLP-[illegible]
11	[illegible]	[illegible]	AGROUND LEAKAGE	0		MODERATE POLLUTION	[illegible] WIS
12	[illegible]	[illegible]	FIRE	0			LLP-[illegible]
13	OPEN	[illegible]	NAVIGATING LEAK TOW WEATHER FOUNDER	0			LLP[illegible]
14	OPEN	[illegible]	HIGH SEAS COLLISION STRUCTURAL DAMAGE	0			WIS
15	PIER	[illegible]	WEATHER AGROUND EXPLOSN FIRE BROKE-IN-2	0		20 MI. BEACHES AND FISHING BEDS, AIR POLLUTION	[illegible] WIS LLP-[illegible]
16	HARB	[illegible]	WEATHER FIRE AGROUND LEAKAGE	0		SLIGHT POLLUTION	WIS-MAR
17	[illegible]	[illegible]	WEATHER STRUCTS HULL RUPT BROKE-IN-2 SCUTTLED	[illegible]			WIS LLP-[illegible]
18	OPEN	[illegible]	NAVIGATING, HULL CRACKS, FIRE	0			LLP-[illegible]
19	[illegible]	[illegible]	WEATHER	0			WIS-MAR
20	[illegible]	[illegible]	UNSPECIFIED	0			WIS
21	[illegible]	[illegible]	COLLISN CONTACT	0			MAR-WIS
22	[illegible]	[illegible]	FIRE EXPLOSN ABANDON	0	HUNDREDS OF THOUSANDS OF FISH KILLED	200 MI. SLICK OFF ECUADOR-COLUMBIA BORDER	WIS LLP-[illegible]
23	OPEN	[illegible]	COLLISN W/[illegible] FOUNDER	0		HEAVY POLLUTION	WIS LLP-[illegible]
24	[illegible]	[illegible]	MACHINE AGROUND	0			LLP-[illegible]
25	[illegible]	[illegible]	NAVIGATING, AGROUND HULL RUPT	0			LLP-[illegible]
26	HARB	[illegible]	AGROUND FIRE EXPLOSN ABANDON	[illegible]	SHELLFISH BEDS	SEVERE POLLUTION	MAR-WIS LLP-[illegible]
27	[illegible]	[illegible]	NAVIGATING, FIRE	0			LLP-[illegible]
28	[illegible]	[illegible]	COLLISN	0			MAR
29	[illegible]	[illegible]	COLLISN	0			MAR WIS
30	OPEN	[illegible]	WEATHER LEAKAGE STRUCTS FOUNDER	[illegible]			[illegible] WIS LLP-[illegible]
31	[illegible]	[illegible]	AGROUND	0			
32	[illegible]	[illegible]	WEATHER AGROUND FOUNDER	[illegible]	FISHERIES & SHELLFISH BEDS AFFECTED	WASHED ASHORE ILE DE SEIN, LATER BRITTANY COAST	MAR WIS LLP-[illegible]
33	[illegible]	[illegible]	[illegible] AGROUND	0			MAR WIS LLP-[illegible]
34	OPEN	[illegible]	HIGH SEAS STRUCTURAL DAMAGE	[illegible]			MAR WIS LLP-[illegible]
35	OPEN	[illegible]	STRUCTS BROKE-IN-2 FOUNDER	0			MAR WIS LLP-[illegible]
36	[illegible]	[illegible]	AGROUND LEAKAGE WEATHER FOUNDER	0		40 MI. COASTLINE	MAR WIS LLP-[illegible]
37	OPEN	[illegible]	WEATHER HULL RUPT LEAKAGE EXPLOSN FIRE FOUNDER	[illegible]			MAR WIS [illegible] LLP-[illegible]
38	OPEN	[illegible]	HIGH SEAS EXPLOSION	0			
39	OPEN	[illegible]	WEATHER MACHINE LEAKAGE FOUNDER	0			MAR WIS LLP-[illegible]
40	[illegible]	[illegible]	COLLISION W/ SHIP	0			
41	HARB	[illegible]	NAVIGATING, EXPLOSION	[illegible]			
42	[illegible]	[illegible]	WEATHER LEAKAGE STRUCTS	0			MAR WIS
43	[illegible]	[illegible]	MACHINE	0			MAR WIS
44	[illegible]	[illegible]	EXPLOSN FIRE ABANDON	[illegible]			MAR LLP-[illegible]
45	[illegible]	[illegible]	WEATHER MACHINE COLLISN W/[illegible] FIRE AGROUND	[illegible]			[illegible] WIS MAR LLP-[illegible]
46	[illegible]	[illegible]	AGROUND LEAKAGE	0			MAR-WIS
47	[illegible]	[illegible]	NAVIGATING, UNKNOWN	0			
48	[illegible]	[illegible]	NAVIGATING	0			
49	[illegible]	[illegible]	MACHINE OTHER AGROUND	0	DEAD FISH & BIRDS, [illegible] TONS OYSTERS DESTROYED	HUNDREDS OF KILOMETERS OF BEACH	[illegible] MAR WIS [illegible]
50	HARB	[illegible]	AGROUND	0			LLP-[illegible]
51	OPEN	[illegible]	AGROUND, SCUTTLED [illegible] MI. OFFSHORE	0		EXTENSIVE POLLUTION	MAR-WIS LLP-[illegible]
52	PIER	[illegible]	UNLOADING	0			
53	[illegible]	[illegible]	UNLOADING EXPLOSION LEAK/FLOODING	0			LLP-[illegible]
54	[illegible]	[illegible]	NAVIGATING NO CAUSE CITED	0			
55	PIER	[illegible]	FIRE EXPLOSION	0			LLP-[illegible]
56	[illegible]	[illegible]	WEATHER HULL RUPT LEAKAGE EXPLOSN FIRE	[illegible]		SLIGHT POLLUTION	[illegible] WIS LLP-[illegible]
57	OPEN	[illegible]	WEATHER EXPLOSION FIRE FOUNDER	[illegible]			LLP-[illegible]
58	PIER	[illegible]	UNLOADING FIRE EXPLOSN SPLIT-IN-2 FOUNDER	[illegible]		SLIGHT POLLUTION	WIS-MAR LLP-[illegible]
59	[illegible]	[illegible]	CONTACT WEATHER	0			MAR
60	[illegible]	[illegible]	AGROUND	0		SLIGHT POLLUTION	MAR-WIS
61	[illegible]	[illegible]	CONTACT ICE DAMAGE SCUTTLED	0			WIS ENVCAN-[illegible]
62	OPEN	[illegible]	COLLISN	0			MAR-WIS
63	PIER	[illegible]	WEATHER COLLISION W/ [illegible] FOUNDER	0			LLP-[illegible]
64	[illegible]	[illegible]	WEATHER COLLISN W/SHIP FIRE ABANDON FOUNDER	[illegible]			WIS-MAR LLP-[illegible]
65	OPEN	[illegible]	WEATHER EXPLOSN FIRE CAPSIZE FOUNDER	[illegible]			MAR-WIS LLP-[illegible]
66	[illegible]	[illegible]	WEATHER COLLISN LEAKAGE FIRE	[illegible]			MAR-WIS LLP-[illegible]
67	[illegible]	[illegible]	WEATHER COLLISN LEAKAGE FIRE AGROUND	0			MAR-WIS LLP-[illegible]
68	OPEN	[illegible]	FOUNDER	0			LLP-[illegible]
69	PIER	[illegible]	EXPLOSN FIRE TOWED ABANDON FOUNDER	[illegible]			MAR-WIS LLP-[illegible]
70	HARB	[illegible]	CONTACT EXPLOSN FIRE	0			MAR
71	[illegible]	[illegible]	AGROUND LEAKAGE	0		SLIGHT POLLUTION	WIS-MAR

	LOCATION			CASUALTIES			REFERENCE SOURCE
	WATER	SEA LOC	SEQUENCE	PEOPLE	BIOLOGICAL	HABITAT	NAME
72	HARB	I	AGROUND SUBMERGED OBJECT, EXPLOSION, FIRE	0		MODERATE POLLUTION	LLP-194
73	RESTR	S	COLLISN W/ MIMOSA FIRE EXPLOSN AGROUND	32		MODERATE POLLUTION, FIRE CONTINUED THRU 11/28/79	MAR-WIS LLP-81
74	RESTR	S	PERSONNEL ERROR COLLISN EXPLOSN FIRE AGROUND	42	IMMENSE ECOLOGICAL DAMAGE	SEVERE POLLUTION	MAR-WIS LLP-217
75	OPEN	S	FRAUD/MUTINY? FIRE EXPLOSION ABANDON FOUNDER	0			
76	PIER	P	EXPLOSN FIRE FOUNDER	2		SLICK SET SPAKTIRIA I COASTLINE ON FIRE	WIS LLP-223
77	RESTR	S	WEATHER RUPTURE EXPLOS STRUCTR FOUNDER	8		CHANNEL ISL., 200KM BRITTANY COAST	DNV WIS LLP-465
78	OPEN	S	EXPLOSION STRUCTURAL DAMAGE	0			
79	OPEN	S	CAPSIZE FOUNDER	40			WIS
80	RESTR	S	AGROUND	0			WIS
81	RESTR	S	WEATHER CONTACT AGROUND	0			WIS
82	PIER	P	ENGINE ROOM EXPLOSION FIRE SCUTTLED	3			LLP96-95
83	RESTR	S	LEAK FOUNDER	0			LLP-187
84	HARB	P	WEATHER AGROUND BROKE IN HALF	0		HEAVILY IMPACTED 25 MI COASTLINE AROUND KLAIPEDA	LLP-188
85	PIER	P	LOADING EXPLOSION FIRE AGROUND	0			LLP-199
86	OPEN	S	FIRE FLOODING BROKE-IN-2 EXPLOSION FOUNDER	0			LLP-50
87	RESTR	S	FIRE HULL RUPT BROKE-IN-2 FOUNDER ABANDON	3	MINIMAL ENVIRONMENTAL DAMAGE 1,500 GANNETS OILED	SLIGHT POLLUTION	LLP-48
88	PIER	P	COLLISN W/ PIER	0			
89	OPEN	S	WAVE STRUCTR FIRE EXPLOSION FOUNDER	6			LLP-372
90	OPEN	S	FIRE EXPLOSION ABANDON LISTING CAPSIZE	0			LLP-365
91	RESTR	S	AGROUND HULL RUPT CRACKED TANKS	0	BEACHES & SEAWALLS OILED, LITTLE ENV. AFFECTED	OIL ON BOLIVAR PENINSULA N. OF GALVESTON, TX	OHR 8.3,9,12 9.67
92	PIER	P	LOADING EXPLOSION FIRE AGROUND	9		POLLUTION	LLP-264
93	PIER	P	EXPLOSN FIRE DURING DISCHARGE FOUNDER	33		733 BBLS WASHED ASHORE ON LALINEA, GIBRALTAR	LLP-367
94	OPEN	S	COLLISN W/ PAN TANKER MAGNUM	0			
95	PIER	P	LOADING EXPLOSION FIRE AGROUND	1			LLP-444
96	HARB	P	STEERING COLLISION (VITORIA-EXPLOSION FIRE)	0			LLP-304(VICTORIA)
97	OPEN	S	EXPLOSION FIRE SPLIT FOUNDER	29			CA STATE LANDS C1990
98	HARB	P	COLLISION	0		EXTENSIVE POLLUTION OF SINGAPORE STRAIT	
99	OPEN	S	WEATHER STRUC FAILURE FIRE FOUNDER	27			CA STATE LANDS C1990
100	RESTR	S	AGROUND	0	FWS MORTAL 36,471 BIRDS, 1,016 OTTERS, 144 EAGLES	OILED 1,000+ SQUARE MILES, 350+ MI. SHORELINE	W.P.325-30,NRT RPT.
101	RESTR	S	AGROUND	0			
102	OPEN	S	COLLISION W/ SHIP	0			
103	PIER	P	COLLISION WITH DOCK	0			
104	RESTR	S	NAVIGATING, FLOODED OR LEAKED, FOUNDER	16			
105	RESTR	S	HIGH SEAS, STRUCTURAL DAMAGE	0			
106	OPEN	S	WEATHER COLLISION HULL RUPTURE F,EX	0			OHR XIII.4,5,6
107	OPEN	S	HEAVY SEAS CAUSED TANK PLATING BREAK	0		5 COVES WITH 15 KILOMETERS OF ROCKY SHORE OILED	
108	OPEN	S	OFFLOADING FIRE EXPLOSIONS	0			UNCORRT, NOAANOTLINE

11-Mar-92

Spills over 5000 Tonnes

	REFERENCE SOURCE					COMMENTS
	OBR	OSR	COGUARD	IFP	OOLOB	
1				7400		
2				7413		
3				7433		
4						
5				7436		
6				7442		
7				7443		
8				7448		
9				7454		COLLISION W/PACIFIC ARES
10				7459		
11				7505		
12				7506		
13				7507		
14				7502		
15				7513		
16				7524		
17			761	7527		IFP &CO FUEL, LLP CARGO WAS CRUDE OIL, CO HAD POLAR PARAGUAY
18				7532		
19				7539		
20						
21				7553		
22				[illegible]		
23				7612		
24				7613		
25				7620		
26				7624		
27				[illegible]		
28						
29				[illegible]		
30				[illegible]		
31				[illegible]		
32				[illegible]		3 DIVERS KILLED IN CLEANUP, SAME AREA IMPACTED AS AMOCOCADIZ
33			497	[illegible]		
34				[illegible]		LOST AT SEA, LAST SITED 90 MI. SE CAPE SABLE 12/29/76
35				[illegible]		
36				[illegible]		
37				7712		??FACTS-ON-FILE
38				7719		
39				7725		
40				7732		
41				7733		
42				[illegible]		IFP HAD CRUDE OIL, PO HAD HEAVY OIL
43				7741		
44				7742		PO HAD REFINED CRUDE, LLP - DIRTY OIL, IFP - LUBE OIL
45						VENOIL, RENAMED RESOLUTE IN 1981
46	[illegible]			[illegible]		
47				7807		
48				[illegible]		
49	[illegible]			7814	11,11	LARGEST TANKER SPILL IN HISTORY LLP-25-27
50				7825		
51	[illegible]			[illegible]		
52				[illegible]		
53				[illegible]		
54				7840		
55				7844		
56	[illegible]			[illegible]		
57	[illegible]			[illegible]		
58	[illegible]			[illegible]		
59						
60	[illegible]			7914		
61	[illegible]			7917		SCUTTLED E. OF SABLE ISLAND [illegible]
62	[illegible]			7921		
63				[illegible]		
64	[illegible]			[illegible]		COLLISION W/EMMANUEL DELMAS
65	[illegible]			[illegible]		
66	[illegible]			7942		COLLISION WITH AEGEAN CAPTAIN
67	[illegible]			7941		COLLISION WITH ATLANTIC EMPRESS
68	[illegible]					2ND SPILL - 1ST ON 7/19/79 DUE TO COLL. W/ AEGEAN CAPTAIN
69	[illegible]			[illegible]		SINGLE POINT MOORING, TOWED 90 MI. TO SEA, SUNK NW PT. NOIRE
70						
71	[illegible]			[illegible]		OBR SHOWS AS [illegible]

Spills over 5000 Tonnes

	REFERENCE SOURCE					
	OBR	OBS	[illegible]	EPP	OCS/OS	COMMENTS
72				7964		
73	79BUM			7967		AGROUND 6 MI. FROM ENTRANCE OF GALVESTON BAY NEW DAY
74	79BUM			7972		COLLISION W/ORE VES. EVIALY
75	1.1,P–48			8002		
76	80BUM			8007		
77	4.13,15 10.13,15			8011		NEAR S.E. DE BATS. LLP SAYS MADAGASCAR. 1980 OBR SUM
78				8028		
79	80BUM			8030		
80	80BUM			8053		
81	80BUM					
82	81BUM			8121		TOWED 26 MI. TO SEA, DRIFTED 3 MOS., SUNK BY FR. NAVY 1981
83				8148		
84	4.47,5.13			8154		
85	5.48			8204		
86	6.3			8301		SANK AT 22-43N, 63-08E
87	83BUM 6.18			8339		LARGEST SPILL IN SOUTH AFRICAN HISTORY
88	83BUM			8344		
89	6.48			8356		
90	6.49			8360		
91	7.30–33,33,34,36			8425		
92				8430		
93	8.21,22 8.47			8521		ADJACENT TANKER CAMPONAVIA CAUGHT FIRE AND SANK
94	9.1,9.2,9.47	5.1,2		8543		
95				8617		
96	X.23, 87BUM					X.23 OBR ACCT. SAYS NO LOSS FROM FUYOH MARU, VITORIA EMPTY
97	11.18 88BUM			8813		
98	88BUM			8823		
99	11.47, 88BUM			8827		
100	12.14–43,46–48	OBR XIII.12–13	2884	8908	1.2,1.3(CS),CW	NAT. RESPONSE TEAM RPT., MAY 1989, WINTER PLAN OBR 12.15
101	12.19,25			8911		
102				8919		
103				8920		
104				8921		
105	12.42(HOT),45,46			8924		LOST HULL PLATING, VERY ROUGH SEAS OIL DISPERSED QUICKLY
106	XII.52,53,XIII.1.5,				II.2,3,4	COLLISION W/METAL TOWER, EN ROUTE FROM IRAN TO N. EUROPE
107	XIII.1,2,3,4,5,6				II.1,2,3,4	
108						

APPENDIX D

MARINE CASUALTY INVESTIGATIONS
TRANSPORTATION SAFETY BOARD OF CANADA

"EXAMPLES ONLY"

- Golden Robin
- Irving Eskimo
- Arctic Link

SUMMARY REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE GROUNDING OF THE STEAM TANKER "GOLDEN ROBIN" OFF DALHOUSIE ISLAND, DALHOUSIE, N.B. ON SEPTEMBER 30, 1974

Investigating Officer:

Marine Surveyor
Ministry of Transport

Particulars of Ship:

Name - "GOLDEN ROBIN"
Port of Registry - Hamilton, Bermuda
Official Number - 185978
Type of Ship - Tanker, of the centre island bridge type
Built - Birkenhead, England - 1953
Length - 629.7'
Gross Tonnage - 17,539.48
Net Tonnage - 10,220.74
Engines - Twin Parsons Steam Turbines - 13750 S.H.P., geared to a single shaft and propeller
Owners - Warwick Shipping Ltd., Read House, Church Street, Hamilton, Bermuda
Cargo - 25968 long tons Bunker "C"
Draft - 34'01½" F 34'07" A (at the time of casualty)

Navigating Equipment:

Radars - Marconi Raymarc 16 - 3 cm.
Marconi Raymarc 12 - 3 cm.
Direction Finder - Benmar ADF 100
Decca Navigator - MK 12
Echo Sounder - Marconi Seagraph
Deep Sea Radio Station - Supplied by Marconi, comprising: Globespan Main transmitter; Atlanta main receiver; Reliance emergency transmitter; Drake emergency receiver
VHF Radio - Marconi Argonault

Persons Interviewed:

Joseph S. Fearon - Dalhousie, N.B. Pilot. Age 44. Pilot's licence issued by the Atlantic Pilotage Authority. 18 years as a pilot.

[redacted] - Master of the "GOLDEN ROBIN". Age 56. Master's Foreign Going Certificate issued in Glasgow, Scotland, July, 1954. 40 years at sea. 20 years as master.

[redacted] - 3rd officer of the "GOLDEN ROBIN". and O.O.W. Age 23. 14 months at sea, 6 months as 3rd officer.

[redacted] - Helmsman of the "GOLDEN ROBIN" at the time of the casualty. Age 53. A.B. Two years at sea.

Numerous other persons employed by or under contract to the Federal Departments of Ministry of Transport, Hydrography Branch of Environment Canada, and Public Works also provided information.

Counsel:

[redacted] Representing: Owners, master and crew

All times in this report are Atlantic Daylight Saving Time: Z - 3 hours.

On September 30, 1974, at 0413, the steam turbine tanker "GOLDEN ROBIN" struck bottom in the Restigouche River, off Dalhousie Island, whilst approaching Dalhousie Harbour. The vessel continued the short distance to the berth, spilling oil from the cargo tanks ruptured in the grounding.

The "GOLDEN ROBIN", after loading a full cargo of Bunker "C" oil in Montreal, P.Q., departed that port at 0116 on September 28 with a destination of Dalhousie, New Brunswick. Passage down the St. Lawrence and through the Gulf was uneventful and the vessel anchored off Miguasha Point, at the entrance to the Restigouche River, at 0159 on September 30 to await the pilot.

Neither the master, [redacted] the other navigating officers, nor the helmsman, [redacted] had been to Dalhousie before. Pilot [redacted] boarded the "GOLDEN ROBIN" at about 0245 but waited to heave up the anchor until 0322 in order to take the vessel in at high water. The time of high water is particularly affected by wind and other factors in this area and after putting the pilot aboard, the pilot boat was stationed at buoy 4D to give advice regarding the direction of the surface flow. Weather conditions at the time were overcast, clear and a light southerly wind.

Leaving the anchorage, after rounding buoy 2D, course was shaped the harbour entrance and, on arrival there, with buoy 2½D fine on the starboard bow, the vessel - on dead slow ahead - was slowly brought to port onto the ranges. At about 0410, when just past buoy 2½D the "GOLDEN ROBIN", still swinging slowly to port, had the harbour approach range lights slightly open and was just north of the leading line when starboard corrective helm was applied; however, the port swing continued. Half ahead, hard-to-starboard wheel, and then full ahead, was ordered to no avail. The vessel continued its port sheer across the channel and at reduced speed at 0413 the vessel struck the shoal water off Dalhousie Island. Immediately after the casualty the vessel was steadied up and, still under the pilot's conduct, taken alongside the discharge berth at Dalhousie Government Wharf.

However, during this last part of the passage, oil was observed to be escaping from the vessel along the port side and, subsequently, a major oil pollution clean-up operation had to be put into effect.

Remarks on the Evidence:

(1) Vessels of this size have been entering Dalhousie since 1964 and the "GOLDEN ROBIN" has, herself, made three voyages into the port since 1972, all without incident;

(2) Sunrise at Dalhousie was at 0721½ on September 30, 1974;

(3) A Hydrographic Service tide gauge recording in Dalhousie on September 30 showed high water to have been at 0425 with a height of 8.35' over chart datum;

(4) The Department of Public Works had let a dredging contract in Dalhousie Harbour, the 1974 program being carried out before and after this casualty;

(5) A Hydrographic survey of the immediate area of the initial sheer of the vessel after the casualty showed that on the line of the approach ranges, about 300 feet past buoy 2½D, there was a sounding of 6.4 metres chart datum and other less-than-charted soundings were in the locality;

(6) The Canadian Hydrographic Service Chart for the area, No. 4426, carries the following caution:

> "All dredged areas on this chart are subject to silting."

(7) The area of Dalhousie Island is undergoing extensive construction work and during 1973 and 1974 various Notices to Shipping were issued regarding Dalhousie (Douglas) Island light, Canadian Light List number 1344. Notice to Mariners No. 148(T) issued on February 8, 1974, advised that the light had been changed temporarily to show one white flash of one second duration with an eclipse of three seconds, having an elevation of 63 feet. A Notice to Shipping issued on May 10, 1974, and still in effect on September 30, reaffirmed that it had been temporarily re-established in the same position of 48°04'19" 66°21'53", with a characteristic of a flashing white light, but at a reduced elevation of 36 feet above high water. On September 30, 1974, the temporary light on a movable structure was found to be some 250 feet to the south east of the stated position;

(8) The amount of Bunker "C" oil spilled in this casualty was estimated at 1500-2000 barrels;

(9) A subsequent survey of the vessel revealed extensive bottom damage and, in particular, numbers one, two and four port wing tanks were noted as holed.

Conclusions:

That the "GOLDEN ROBIN" when entering Dalhousie, N.B., on September 30, 1974, struck a shallow area, being a shoaling of the Middle Ground bank to the southeast and the vessel then sheered to the southern side of the channel, off Dalhousie Island, where extensive bottom damage was incurred.

OTTAWA, December 30, 1974.

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE BOTTOM CONTACT DAMAGE SUSTAINED BY THE CANADIAN TANKER "IRVING ESKIMO" IN TRAVERSE DU NORD CHANNEL, ST. LAWRENCE RIVER, DECEMBER 6, 1983 AND RESULTING IN THE LOSS OF PART OF HER OIL CARGO.

REPORT N°358

Ce rapport est aussi disponible en francais

MARINE ADMINISTRATION
Marine Casualty
Investigations

Ottawa
Ontario

The contents of this report are confined to cause-related circumstances and are released for accident prevention purposes only and may be deficient and misleading if used in any other process.

ADMINISTRATION MARITIME
Enquêtes sur les accidents
maritimes

Ottawa
Ontario

Le contenu de ce rapport ne porte que sur les circonstances entourant le cas à l'étude et n'est publié qu'à des fins de prévention des accidents et peut être insuffisant et trompeur s'il est utilisé pour d'autre fins.

Transport Canada Transports Canada

Marine Marine

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE BOTTOM CONTACT DAMAGE SUSTAINED BY THE CANADIAN TANKER "IRVING ESKIMO" IN TRAVERSE DU NORD CHANNEL, ST. LAWRENCE RIVER, DECEMBER 6, 1983 AND RESULTING IN THE LOSS OF PART OF HER OIL CARGO.

Particulars of Vessel

Name	"IRVING ESKIMO"
Official Number	369839
Call Sign	V C J R
Port of Registry	Saint John, N.B.
Type	Tanker
Length	191.57 m
Breadth	27.49 m
Depth	14.74 m
Gross tonnage	23,377
Net tonnage	15,434
Built	1980, Saint John, N.B.
Propulsion	8 cylinder, Burmeister and Wain Marine diesel engine, 17,300 BHP, driving single, bridge-controlled, controllable-pitch propeller, 16 knots at 115 rpm.
Bow Thruster	bridge-controlled, controllable-pitch propeller.
Cargo	234,191 barrels of No.6 Bunker 'C' fuel.
Draught	11.22 m F., 11.22 m A.
Classification	Lloyds Register of Shipping, Ice Class 1A.
Owners	Irving Oil Ltd., 284 Union Street, Saint John, N.B.
Operators	Kent Lines Ltd., 230, Bayside Drive, Saint John, N.B.

Navigating Equipment

Radar (1)	Decca AC 1229
Radar (2)	Decca 7 MS 1630A
Collision Avoidance System	Sperry - C.A.S. II
Direction Finder	Marconi Lodestone
Loran 'C'	Internav LC 123
Sat Nav	Navidyne ESZ 400
Echo Sounder (1)	Simrad
Echo Sounder (2)	Simrad

Canada

Navigating Equipment (cont'd)

V.H.F. (1)	Standard Communication Corp.
V.H.F. (2)	Standard Communication Corp.
Gyro Compass	Sperry with 10 gyro repeaters
Course Recorder	Sperry
Magnetic Compass	Reflecting type

Description of vessel

The "IRVING ESKIMO", an ice-strengthened oil tanker, ice class 1A, was classed by Lloyd as +100A1, +LMC. The cargo tanks, are located forward of the bridge and accommodation; under the accommodation the engine room is separated from the tanks foreward by a pumproom. The 21 cargo tanks are comprised of 7 port wing, centre and starboard wing tanks. She is equipped with an auto-pilot and an electro-hydraulic steering system. The course recorder was not in use at the time of the incident.

Background

All times in this report are in Eastern Standard Time (UTC* minus 5 hours), unless otherwise stated.

The "IRVING ESKIMO" departed Québec City, Québec, at 1012, December 6, 1983, bound for Sept-Iles, Québec, en route to Stephenville, Newfoundland, with 234,191 barrels of No.6 Bunker 'C' oil cargo. The vessel had the services of two St. Lawrence River Pilots for her transit.

Whilst transitting "Traverse Du Nord" channel, the vessel contacted the starboard edge of the channel a number of times, between buoys K107 and K111, sustaining damage to the bottom plating in way of No.1 starboard tank.

Whilst there were no deaths or injuries, there was some pollution as a result of this incident.

Narrative

The "IRVING ESKIMO" completed loading a cargo of 234,191 barrels of No.6 Bunker 'C' oil at 0930, December 6, 1983, at an even keel draught of 11.22 metres in fresh water (FWA** is 25 cm).

Two St. Lawrence River pilots boarded the vessel and were advised of the vessel's loaded draft, and of an assumed squat, at the normal service speed, of some 1.2 metres. Consequently, it was intended that the vessel proceed initially at a service speed of 100 rpm which could be increased to 110 rpm, if no vibrations were felt.

The vessel departed Ultramar dock, Québec City, Québec at 1012, December 6, 1983, about 3 hours after high water at Québec, bound for Sept-Iles via Les Escoumins Pilot Station. After clearing the dock at 1027, the intended procedure regarding speed was followed.

The tanker transitted the St. Lawrence River, reporting to "Channel Québec" at various CIP's***. At 1100 the tanker was reportedly in position 40°50.4'N 71°04.2'W, passing CIP #12 at 1112 and abeam of Ile Madame at 1150. At 1158, the "IRVING ESKIMO" was abeam of St. François Public wharf, Ile d'Orléans, on a course of 033°(gyro), when a position plotted by the OOW****

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* UTC = Co-ordinated Universal Time
** FWA = Fresh water allowance.
*** CIP's = Call-in Points
**** OOW = Officer of the Watch.

Narrative (cont'd)

positioned the vessel close to the starboard edge of the channel. The vessel passed Pointe Argentenay at 1205 hours, when another position was taken and plotted by the OOW which also showed the vessel to be close to the starboard edge of the channel, with the vessel averaging 15.9 knots over the ground.

The weather at this time was reported to be: light winds with snow, visibility variable between 0.25 and 1 mile. In view of this, the nearest range at 3 miles was not visible from the ship.

At about 1210, the pilot reported to the Master that he felt the vessel had touched bottom slightly a number of times and consequently ordered a change of course from 033°(T) to 028°(T). Although very slight vibrations were felt on the bridge of the vessel, none of the ship's personnel manning the bridge considered that the vessel had come in contact with the bottom, but the crew working on deck heard scraping sounds forward and reported this to the bridge. The two echo sounders in the chart room revealed that the vessel had encountered shallow water, the traces being close to and merging with the bottom line of the vessel's keel. At the time the first bottom contact was felt, the vessel was reportedly 3 miles from the forward leading light of the Banc du Cap Brûlé lighted range.

After passing the upbound vessel "MADELEINE" port to port, the "IRVING ESKIMO" was slowed down to assess if any damage had taken place. Ullages were taken and showed no significant change to those taken earlier. There were no visual signs of loss of oil from the vessel to indicate any possible damage. The situation was monitored on a periodic basis and the vessel then resumed her passage at 100 rpm, reaching Les Escoumins at 1942, December 6, 1983. After disembarking the pilots, the vessel proceeded towards Sept-Iles at 1948 maintaining 110 rpm.

The weather continued to deteriorate throughout the night and by 0300, December 7, 1983, the winds reached an estimated speed of 45 knots from an ENE'ly direction, at which time the vessel's course was altered to 037°(T) from a position 13.5 miles south of Pointe des Monts. As she was encountering rough seas, strong winds and blowing snow; sea and spray were being shipped over the starboard side by 0420.

At 0650 the engines were reduced to 90 rpm. At 0700 the vessel's position was 15.6 miles east of Iles aux Oeufs.

At 0730, December 7, 1983, bunker 'C' cargo oil was observed on deck forward of the bridge. Upon investigation, the source of the oil leakage was traced to No.1 starboard wing tank; the circumstances of the finding were reported to the authorities at 1008.

The vessel continued her voyage, taking a number of precautionary measures, including proceeding at slow speed, heaving-to at times, and inducing a water-layer in the bottom of No.1 starboard tank. The vessel finally arrived at Sept-Iles, berthing alongside Imperial Oil dock at 1746, December 7, 1983. Arrival ullages were taken and the cargo was calculated to be 232,085 barrels, indicating a shortage of some 2,106 barrels of bunker 'C' cargo.

Due to strong SW'ly winds and heavy swell, the berth became untenable and, despite large tire fenders on a sprung dock, the vessel sustained an indentation on the port quarter and was subsequently moved to an anchorage at 0106, December 8, 1983, with the assistance of 2 tugs.

An underwater shell inspection was carried out by a local diving firm during the midmorning of December 8, 1983. Later that day, a detailed underwater survey was carried out by another team

Background (cont'd)

of divers who confirmed the earlier divers' report indicating a puncture/fracture in way of No. 1 starboard tank bottom plating and a few other indentations. The vessel also sustained heavy weather damage to her bulwarks and plating. Following temporary underwater repairs, the tank was pumped out, gas freed and examined internally. Additional temporary repairs were effected to the satisfaction of the Classification Society surveyor to enable the vessel to complete her voyage.

This incident resulted in pollution of the sea due to some 2,106 barrels of No. 6 Bunker 'C' fuel oil having been spilled.

Remarks

1. Caution and channel information in the "Sailing Directions-Gulf and River St. Lawrence" read:

   > "Traverse du Nord...channel, east of Ile d'Orléans, has a least width of 305 m (1,000 ft) and it is marked with leading lights and buoys. The channel was dredged to a depth of 12.5 m (41 ft), however....
   > Caution: - Silting has been reported in the river channel between Cap Brûlé and Saint-Jean; there may be less water than shown on the chart. For exact depths in the channel, mariners should contact the Canadian Coast Guard Information Centre, Montréal District...."

   All navigational floating aids were decommissioned for the winter months but buoys in the immediate area of the incident, K...108, 112, 116 and 120 were replaced with winter spar buoys. No allegations were made that these buoys were not in place.

2. In the fall of 1983, due to shortage of time, the dredging contractor was unable to complete the dredging operations for the full width of the channel, but it was dredged to a width of 125 m on either side of the centre line of the charted channel. The pilots were made aware of this restriction through the Laurentian Pilotage Authority, who were advised by the Aids and Waterways division of the Canadian Coast Guard.

   Notice to Shipping #13255 reporting the reduction in "Traverse du Nord" channel width was issued on December 19, 1983, some 13 days after this incident and thus, the Master was not aware of the information.

3. Following dredging operations, soundings taken on October 22, 1983 by a hydrographic surveying team and subsequently by CCGS* "J.E. BERNIER" on December 12, 1983 have shown a minimum depth of 12.5 m in the channel in the vicinity of the incident.

4. Based on a study conducted by the Ocean Science and Surveys division of the Department of Fisheries and Oceans titled "Variability of Temperature, Salinity and Tidally Average Density in the Middle Estuary of the St. Lawrence", the water density in the area was between 1001-1002, i.e. almost fresh.

5. Based on the information contained in the "Canadian Tide and Current Tables, Volume 3-1983", high water at St-François was at 0634, December 6, 1983 with a predicted height of 5.12 m and low water at 1340 with a predicted height of 0.49 m; the height of tide at 1210, the time of incident, was calculated to be 0.97 m., whilst that recorded by St-François tidal gauge was 1.09 m.

* CCGS - Canadian Coast Guard Ship

Remarks (cont'd)

The channel depth at 1210, December 6, 1983 was then 12.5 m + 1.09 m = 13.59 m, giving the "IRVING ESKIMO" a calculated underwater clearance of 13.59 - 11.22 = 2.37 m (fresh water).

6. The flood and ebb tidal streams in "Traverse du Nord" channel run parallel to it and their maximum rates are shown on the chart to be 2 knots and 2.5 knots respectively.

7. The vessel's speed over the ground with a 2 knots ebb stream was 15.9 knots, thereby indicating that her speed through the water was 13.9 knots.

   A "squat"* analysis prepared by the Waterways Development Division of Canadian Coast Guard, based on the assumption that the vessel was travelling mid-stream within the confines of the reduced channel width of 250 m, at a velocity relative to the water of 7.15 m/sec (13.9 knots), indicates that the squat of the "IRVING ESKIMO" would have been 1.52 m.

   Hence the net dredged channel under-keel clearance of the vessel was 2.37 m - 1.52 m = 0.85 m (fresh water).

8. Notice to Mariners No. 466 of 1979, St. Lawrence River Below-Québec - Under-keel clearance, states that:

> "'(St. Lawrence Waterway) Marine Traffic Regulations' (SOR/71-318) require a vessel to obtain a clearance as a prerequisite for transit through the area.
>
> The granting of clearances to deep draft vessels transitting downstream of Québec City is conditional on their compliance with the criteria set out in the publication, 'Vessel Performance in Confined and Restricted Channels of the St. Lawrence River'........."

   which indicated that, in addition to the squatting allowance, an allowance of 0.61 m is required for safe manoeuvrability. However, a caution/warning contained in the former states that:

> "Clearances issued in accordance with the above do not relieve the Master or officer-in-charge of their ultimate responsibility for the safety of the vessel at all times."

   Those aboard the vessel were aware of this information and of an estimated 1.2 m squat experienced by the vessel in the past. After discussing the under-keel clearance, it was decided to proceed at 100 rpm initially and if no vibrations were encountered to increase to 110 rpm.

9. Because of the reduced visibility of 0.25 - 1.0 mile, the vessel was navigated by radar. The vessel's progress was monitored by the OOW taking fixes at intervals of 10 to 15 minutes. The fixes obtained at 1158 and 1205 respectively, both placed the vessel off the centre line and close to the eastern edge of the "Traverse du Nord" channel. At 1200, the vessel was steering a course of 033°(T) which was designed to keep her heading on the leading lights of Banc du Cap Brûlé. The first contact with the bottom, which was slight, was felt at 1210, when the vessel was about 3 miles from the charted Banc du Cap Brulé Beacon, and lasted for a while. Then a second bump, more pronounced, was felt by the senior Pilot, at which time the vessel's course was adjusted to 028°(T) and thereafter no further contact with the bottom was felt. The gyro error was stated to be nil.

* Squat is the apparent increase of draught due to the motion of a vessel through the water.

Remarks (cont'd)

Some crew members heard scraping sounds forward and reported this to the bridge; the sounds were later estimated to have lasted for approximately 3 minutes.

At the time of the bottom contact the Master, responding to a call from the Chief Engineer, was unable to confirm if the vessel was in or near the mid-channel, but shortly thereafter he observed on the radar screen that the radar echoes of the two leading ranges were almost in line on the heading marker.

10. a) Neither the meeting with the upbound vessel "MADELEINE" at buoy K108, nor the overtaking of the downbound vessel "J.A.Z. DESGAGNES" below Cap Brûlé at 1250, in any way interfered with the navigation of the "IRVING ESKIMO".

b) All the navigating equipment required for the safe navigation of the ship was in operation and in good working order at the time of the incident.

c) There were no problems reported with either the main engine or the steering gear.

11. The weather conditions were as follows:

- at about 1942, December 6, 1983, off Les Escoumins pilot station; NE winds at 25 knots, moderate sea and swell, overcast and snow, visibility 3 to 4 miles;
- at 0300, December 7, 1983, off Pointe des Monts NE x E winds at 45 knots, rough seas, snow and blowing snow, visibility 3 miles; and
- the wind continued to increase, reached an estimated speed of about 60 knots by 0700, remained at that speed till 1000 and gradually diminished to 15 knots by 1500.

12. Shortly after the bottom contact, initial investigation by the chief officer and the OOW revealed no signs of bottom fracture or oil leakage. This was probably due to the combined effect of the vessel's speed over the ground and the relatively low *oil head in No.1 starboard tank in relation to the sea level. However, during the night, as the vessel encountered heavy seas, the "IRVING ESKIMO" commenced leaking Bunker 'C' oil cargo from No. 1 starboard tank, which was discovered at 0730, December 7, 1983, when traces of Bunker 'C' oil, left by the shipped seas were observed on deck forward of the accommodation. This was confirmed with a drop in the ullage recorded in No. 1 starboard tank and traces of oil alongside the vessel.

Upon moderation of the weather, part of the cargo in No. 1 starboard tank was transferred to No. 3 starboard tank and a layer of water induced in the bottom of the former. This layer of water was partially successful in controlling the oil leakage and thereby preventing further loss of cargo.

Approximately 2106 barrels of bunker 'C' fuel was spilled into the sea as a result of this incident.

13. The loss of cargo was reported to the vessel's managers in Saint John, N.B. on the company radio frequency, shortly after the oil leak was first observed at 0730, with a request to notify the authorities. The incident was not reported directly to the authorities until 1000 due to reported heavy static and coastal radio stations being busy with other emergencies.

* After making allowance for the squat effect.

Remarks (cont'd)

14. External inspection of the bottom damage to the vessel was carried out on December 9 and 10, 1983 while the vessel was anchored at Sept-Iles, Quebec.

    Bottom damage in way of No. 1 starboard cargo tank was also inspected internally following temporary repairs by divers which permitted the tank to be pumped clear and gas freed.

    Some seepagw of sea water from the newly driven cedar wedges was present, with approximately 10 cm of loose water retained between longitudinals 12 & 13, which partially obscured the bottom shell plating in that area.

    The bottom longitudinal stiffening appeared to be undamaged. No significant buckling could be detected and only the bottom of the transverse web frame No. 92 was buckled in way of the setup of the bottom shell between bottom longitudinals 12 & 13.

    Bottom and side shell plating aft of the No. 1 starboard cargo tank was not inspected, as cargo was still loaded and not due for discharge at that time. No leakage or change in ullages was apparent in any cargo tanks other than No. 1 starboard and the diver's preliminary report indicated that only relatively minor shell buckling and superficial scraping was apparent and clear of the actual fracture in the shell.

    Because of the cargo discharge and delivery schedule, temporary repairs were put in hand and a quick drying cement box approximately 3.6 m in length was to be fitted in way of the fracture between longitudinal 12 & 13.

    No internal shell damage was detectable in the compartments forward of No. 1 cargo tank and regular soundings confirmed no change in water levels, indicating that the shell plating was intact.

15. a) The Master of the "IRVING'ESKIMO" holds a British Master's Foreign Going Certificate issued in October, 1947. He has 29 years experience in the marine industry of which 15 years were sea-going. He served in the capacity of a Master for 9 years and has been aboard this vessel for 3 years.

    b) The chief officer of the "IRVING ESKIMO" holds a British Master's Foreign Going Certificate issued in April 1958. He has a total of 20 years sea service, of which 2 years were as chief officer/relief Master with the same company.

    c) The second officer of the "IRVING ESKIMO" holds an OM 2 certificate issued in March, 1983. He has served as a deck officer since 1980 and has been on this vessel for 4½ months.

    d) The two St. Lawrence River Pilots hold Pilot Class A licences and have been with St. Lawrence River pilots since 1965 and 1975 respectively.

Findings

It would appear that:

- the "Irving Eskimo" sustained bottom damage between the positions of buoys K107 and K111 at 1210, December 6, 1983, as a result of bottom contact with the eastern edge of "Traverse du Nord" channel due to an error in navigation in reduced visibility conditions;

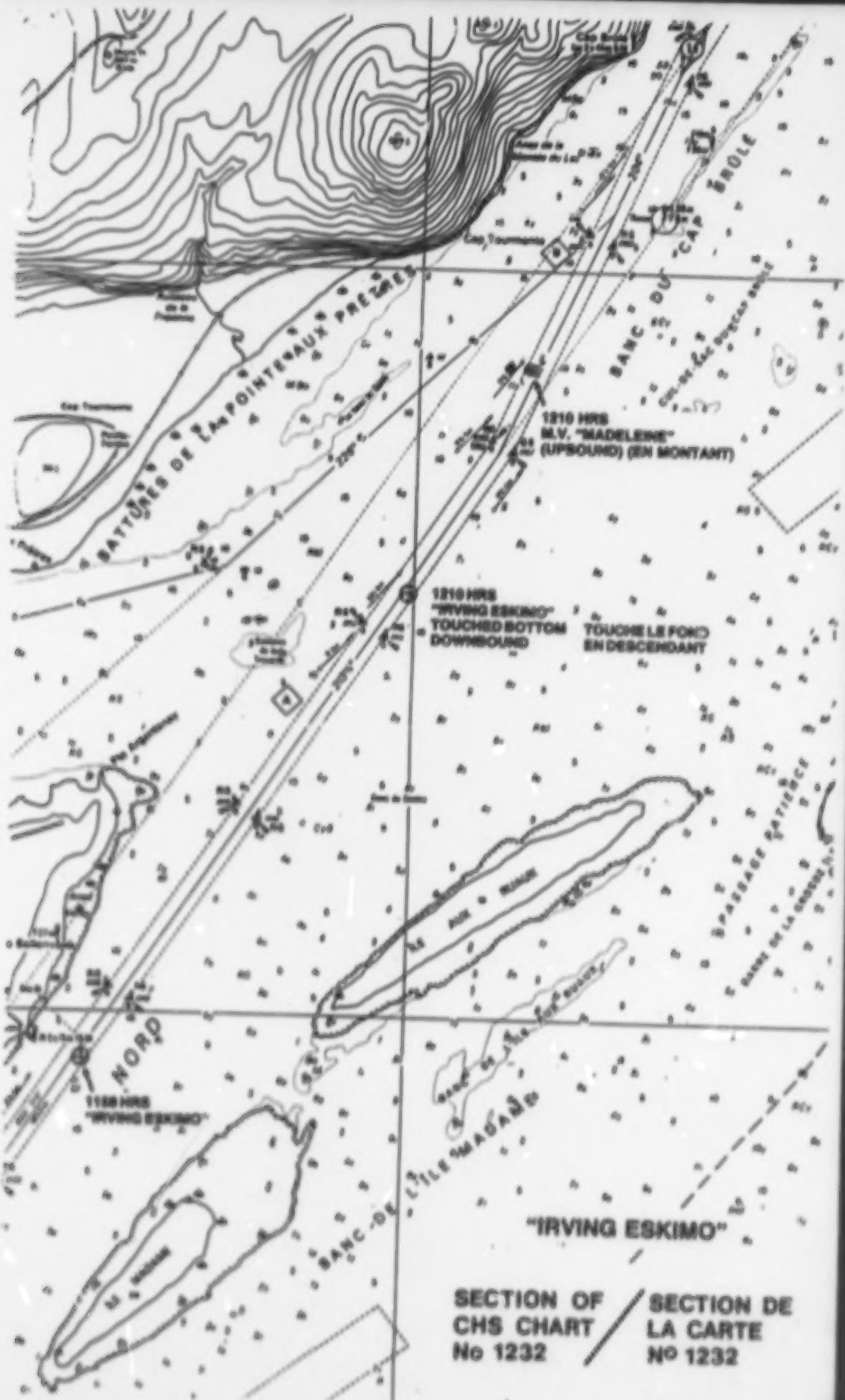
Findings (cont'd)

- the bottom contacts were felt by the Pilots but not the Master, all of whom were on the bridge, and scraping noise was heard by crew members on deck;
- damage and the loss of cargo was evident only at the onset of the vessel encountering bad weather and was first observed at 0730 the following day, and
- there was a loss of approximately 2106 barrels of No.6 Bunker 'C' oil cargo from No. 1 starboard tank. The inducement of a layer of water on the bottom of that compartment, controlled to a limited extent the further loss of cargo.

Contributing to this bottom contact are the following:

- excessive speed in areas of minimum underkeel clearance;
- the reduced width of the channel to 250 m instead of 305 m, due to curtailed dredging maintenance in the previous fall season and which was known only to the Pilots and not the ship's officers;
- the lack of appreciation of the vessel's plotted positions which indicated that she was not in mid-channel, but close to the starboard edge;
- the reduced visibility of 0.25 to 1.0 mile due to snow, and
- the difficulty in locating the winter spar buoys.

OTTAWA, ONT.
JULY, 1985



"IRVING ESKIMO"

SECTION OF CHS CHART No 1232 / SECTION DE LA CARTE Nº 1232

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE GROUNDING OF THE CAYMAN ISLAND REGISTERED VESSEL "ARCTIC LINK" IN HAMILTON INLET, LABRADOR, ON JULY 1, 1984.

REPORT N° 314

Ce rapport est aussi disponible en français.

MARINE ADMINISTRATION Marine Casualty Investigations	ADMINISTRATION MARITIME Enquêtes sur les accidents maritimes
Ottawa Canada	Ottawa Canada
The contents of this report are confined to cause-related circumstances and are released for accident prevention purposes only.	Le contenu de ce rapport ne porte que sur les circonstances entourant le cas à l'étude et n'est publié qu'à des fins de prévention des accidents.

Transport Canada Transports Canada

Coast Guard Garde côtière

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE GROUNDING OF THE CAYMAN ISLAND REGISTERED VESSEL "ARCTIC LINK" IN HAMILTON INLET, LABRADOR, ON JULY 1, 1984.

Particulars of Vessel

Name	"ARCTIC LINK" (ex. "BARDALAND")
Port of Registry	Georgetown, Cayman Island
Official Number	708121
Call Sign	ZHCT
Type	General Cargo
Gross Tonnage	5570.76
Net Tonnage	2847.93
Length Overall	145.45 m
Extreme Breadth	19.46 m
Depth to Upper Deck	11.30 m
Built	1973
Propulsion	MAN diesel engine, 9 cylinder, single screw 9000 BHP
Class	Det Norske Veritas 1A1-ICE 1A
Owners	Atlantic Link Trading Ltd. P.O. Box 1350 Georgetown, Cayman Island, B.W.I.

Navigational Equipment

Radar (A) Decca RM 1226
Radar (B) Decca RM 916
D.F. ITT Marine
Decca Nav. MK21
Sat. Nav. Racal-Decca (Sat.Nav.DS5)
VHF ITT Marine STR 65
Echo Sounder BELLATRIX LAZ 17HT3
Course Recorder ANSCHUTZ KIEL

This is a general cargo vessel of steel construction built in Rostock, East Germany, in 1973, single screw, with three holds and five hatches. The accommodation and machinery are located aft.

Background

The cargo ship "ARCTIC LINK" departed Philadelphia, U.S.A. on June 27, 1984, in ballast condition, bound for Goose Bay, Labrador. She carried a crew of 17 and 5 guests.

On July 1, 1984, whilst traversing the approaches to Goose Bay and in Hamilton Inlet, the vessel's course was altered to steam between Big Island and East Sister Island. Moments prior to the vessel grounding, the helm was put "hard-a-port" and the engine was stopped as it was realized that the vessel was in the wrong position. The "ARCTIC LINK" ran aground on a shoal located between Pompey Island and Big Island.

Some pollution was released from the vessel immediately after grounding.

Background (cont'd)

On July 13, 1984, after discharging some heavy fuel into the supply vessel "OFFSHORE TRADER", the vessel was refloated at high water under her own power and proceeded towards St. John's, Nfld, where she arrived safely on July 17, 1984.

The vessel sustained considerable bottom damage and repairs were carried out in St. John's.

There were no personal injuries due to the grounding and the amount of pollution was considered minor.

Narrative

All times in this report are in Atlantic Daylight Time (UTC* minus 3 hours)

On June 27, 1984, the Cayman Island general cargo ship "ARCTIC LINK" departed Philadelphia, U.S.A., on a time charter and in the ballast condition, destination Goose Bay, Canada.

There were 17 crew members and 5 guests on board.

Departure draught was forward 4.12 m, aft 5.49 m, mean 4.80m.

The vessel was carrying 533 tons of heavy fuel, 105 tons of diesel fuel, 58 tons of lube oil and a total of 1,222 tons of water ballast.

On June 29, 1984, the Master of the "ARCTIC LINK" was in contact with ECAREG** Canada. He also received ice information and routing from Coast Guard Ice Operations, St. John's.

The "ARCTIC LINK" carried 17 crew members and 5 guests; there were 3 deck officers and a Master. The Master did not stand watch.

The watch of the second mate was from 0000 - 0400 and 1200 - 1600.

The watch of the third mate was from 0400 - 0800 and 1600 - 2000.

The watch of the chief mate was from 0800 - 1200 and 2000 - 2400.

There were four AB's on board, of which one AB was assigned to each watch and the fourth one was on day work.

In the early morning of July 1, 1984, the "ARCTIC LINK" was steaming through the Strait of Belle Isle in restricted visibility (fog patches) and in the vicinity of icebergs. This weather and ice conditions remained unchanged until about 1900 hours when the visibility improved to 10 miles, at which time the vessel was making its approach to Hamilton Inlet.

The Master was in the wheelhouse during the period. He had the conduct of the vessel most of the time and the vessel was on various courses.

The Master was expecting to anchor the vessel off Jordan's Point at approximately 2200 hours, where on the following morning he was to pick up the local pilot for Goose Bay. Having decided to take a pilot the options had been to pick one up either at St. John's, Nfld, Port aux Basques, Nfld, or in Goose Bay upon arrival; it was decided to pick up the pilot at the pilot station in Goose Bay.

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* *UTC - Coordinated Universal time (replaces GMT)*

** *ECAREG - Canadian Coast Guard Eastern Canada Traffic System - Information Centre.*

Narrative (cont'd)

As the vessel entered Hamilton Inlet, U.S. Chart NO. 15072 (Hamilton Inlet Entrance) was in use. At 1935 hours in position Lat. 54°19'11"N, Long. 57°19'25"W, a radar fix was taken by the third mate while the Master was in the wheelhouse. The Master left the wheelhouse shortly afterwards.

At 2000 hours the third mate plotted the ship's position by radar, Saddle Island bearing 246°, distance 8 miles, at which time the chief mate took over the watch from the third mate. The vessel was on auto pilot, the course was 270° T & G, and at full speed (15 knots). The chief mate laid down the courses to follow, the Master having previously sketched the required route on U.S. Chart No. 15072.

The vessel's two radars were in operation. However, the chief mate was using the starboard radar only (Decca RM 1226) at 6-mile range. The third mate remained in the wheelhouse after completing his watch.

At 2045 hours the engineer on watch changed from heavy fuel to diesel fuel. The engine was on "bridge control".

The chief mate was using the radar mechanical cursor and the range marker to check that the vessel was following the charted course.

When the "ARCTIC LINK" was abeam of Little Black Island, the chief mate altered the course to 240° T & G. It was daylight and the small light beacons located at the north end of the Island were observed. Shortly afterwards the chief mate started looking for Big Island on the radar for the next course alteration. Apparently, Big Island was seen on the radar as two islands. Without plotting the vessel's position, the vessel's course was altered to about 275° - 280° T & G in the assumption that the "ARCTIC LINK" was steaming between Big Island and East Sister Island. The vessel remained on that course for a period of approximately 5 minutes. The chief mate was looking for the lighthouse on the east end of Big Island and when he could not find it, he started checking the distance from land on the radar. The Master came back on the bridge at about that time.

It was then realized that the vessel was in the wrong position; the auto pilot was put 'hard to port' and then switched from auto pilot to hand steering, again putting the helm 'hard to port'. The Master ran to the telegraph and stopped the engine.

At 2105 hours the M.V. "ARCTIC LINK" grounded in position Lat. 54°17'55"N. Long. 58°00'10"W, on a shoal located between Pompey Island and Big Island.

Weather conditions at the time were clear, visibility 10 miles, northerly wind 5 knots, calm sea and air temperature +5°C. High water was at 2203 hours at a height of 2.0 metres.

At the time of grounding there were 5 persons on the bridge - the chief mate, third mate, a lookout on the wing, the Master and his wife. The ship's head after grounding was 257° T & G. The rudder angle was 35° port.

The crew took soundings of the bilges and found them dry. The engineers found the following tanks damaged:

Tank No. 5.1 starboard (160 m^3 of heavy fuel)
Tank No. 5.3 starboard (empty)
Tank No. 5.5 starboard (empty)
Tank No. 1.2 centre overflow tank (5 tons of heavy fuel)
Tank No. 3.0 starboard (fresh water for feeding the boiler)

Narrative (cont'd)

The following water ballast tanks were also apparently damaged:

Tank No. 4.0 forepeak (500 m^3)
Tank No. 4.1 centre (242 m^3)
Tank No. 4.5 starboard (160 m^3)

At 2115 hours the Canadian Coast Guard and the owners were advised of the grounding. The Coast Guard despatched the Cutter "SKIDEGATE" to the assistance of the grounded vessel where the Coast Guard vessel remained until July 6, 1984.

Between 2130 and 2250 hours the engineers operated the main engine in order to clear all heavy fuel from the engine's main injectors. As a result of the grounding, the heavy fuel tank No. 5.1 was ruptured releasing some fuel and causing minor pollution.

On July 7, 1984, the Canadian supply vessel "OFFSHORE TRADER" arrived at the scene. The Coast Guard Emergency team were on board the supply vessel with their equipment to assist in pumping out the fuel from the grounded vessel and on July 8, 1984, they started discharging heavy fuel from tank No. 5.1 into barges.

On July 9, 1984, the "OFFSHORE TRADER" positioned herself closer to the "ARCTIC LINK" in order to discharge the oil directly into the supply vessel without using barges. Pumping commenced from tank No. 5.2 directly into the supply vessel. Some of the fuel was transferred internally to tank No. 5.2.

On July 12, 1984, at 0815 hours, the "ARCTIC LINK" received a certificate from the Coast Guard Emergency team that she was pollutant free and permission was granted to start blowing operations (pumping air into damaged ballast tanks to assist in refloating the vessel).

On July 13, 1984, at 2000 hours preparation was made to list the vessel to assist the refloating by using a weight of approximately 10-15 tons, and swinging it over the ship's side. At 2045 hours 'full maximum astern' was ordered and the vessel started moving slowly and both anchors were then let go being recovered shortly afterwards.

At 2055 hours the "ARCTIC LINK" was refloated at high water by her own efforts and under her own power. At 2115 hours the vessel was anchored and started ballasting some of her tanks.

On July 14, 1984, a diving inspection was carried out. The draught of the vessel after ballasting was forward 3.40 m, aft 5.60 m. The vessel was then anchored south of Catos Island at a distance of .75 miles. On July 15, 1984, at 0600 hours a temporary certificate was granted from the Classification Society for the vessel to proceed to St. John's, Nfld. At 0700 hours the "ARCTIC LINK" was under way towards her destination.

On July 17, 1984, at 1700 hours the "ARCTIC LINK" arrived safely in St. John's harbour and was secured at Pier 36; then on July 19, 1984, the vessel entered the local dockyard for repairs.

Remarks on the Evidence

1. At the time of grounding, the "ARCTIC LINK" was on auto pilot and steaming at full speed (14-15 knots). The speed of the vessel with the flooding tide was calculated to be approximately 17 knots.

   There was no other ship in the vicinity.

Remarks on the Evidence (cont'd)

There was no malfunction in the ship's machinery, steering, or the electrical system prior to or at the time of grounding.

2. Weather conditions were good and it was daylight. The vessel's ETA* for the overnight anchorage off Jordans Point was 2200 hours. Sunset was at 2135 hours, with civil twilight at 2229 hours and nautical twilight at 2309 hours.

3. There were two radars in operation. The chief mate was using only the starboard radar (Decca RM 1226) at 6-mile range. The radar has a reflector plotter, variable and fixed range markers, mechanical cursor, unstabilized and stabilized display. The port radar has the same features except for the variable range marker.

   Both radars were found to be operating satisfactorily.

   The vessel is equipped with an echo sounder. However, it was not in use at the time.

4. The Master had sailed with the chief mate for a period of about 2-3 years on various ships.

   The Master was in the wheelhouse for a few minutes prior to the grounding and he did not take over the navigation of the vessel from the chief mate, neither did he ascertain the vessel's position during that time.

   It should be noted that neither the Master nor the chief mate had ever sailed in the local coastal waters of Labrador before this incident.

5. Goose Bay is not a compulsory pilotage area. The Master made arrangements to pick up a pilot at the assigned pilot boarding station off Double Mer Point the following day, as the vessel was to anchor off Jordan's Point overnight. The intended anchorage position is in the vicinity of the pilot boarding station.

6. The following tanks were found damaged after surveying the vessel at the Dockyard in St. John's:

   Tank 4.1 W.B., Frame 176-149
   Tank 4.2 W.B. Port side, Frame 142-117
   Tank 4.3 W.B. Starboard Side, Frame 149-117
   Tank 4.4 W.B. Port side, Frame 117-74
   Tank 4.5 W.B. Starboard Side, Frame 117-74
   Tank 5.0 H.F.O. Port Side, Frame 149-96
   Tank 5.1 H.F.O. Starboard Side, Frame 149-96
   Tank 5.3 H.F.O. Starboard Side, Frame 96-43
   Tank 5.5 H.F.O. Starboard Side, Frame 74-43
   Tank 1.2 H.F.O. Cross, Frame 43-40
   Tank 3.0 Feed Water Starboard Side, Frame 39-31

7. Prior to the "ARCTIC LINK" departure from Philadelphia, U.S.A., the most recent U.S. Publications for the East Coast of Canada were purchased:

   - Sailing Directions (Pub. 146, Newfoundland/Labrador, 1984)
   - Tide Tables for the Atlantic Coast of North America, 1984. (U.S. Department of Commerce)
   - Tide Tables for the East Coast of North and South America, 1984

*ETA - *Estimated Time of Arrival.*

Remarks on the Evidence (cont'd)

- List of Lights (Pub. 110, Greenland East Coast of North and South America, 1984)
- Latest Notice to Mariners aboard the vessel was No. 24/84
- Pilot Chart of the North Atlantic Ocean, U.S.A.
- The vessel was also carrying the British Admiralty List of Radio Aids.

At the time of grounding U.S. chart No. 15072 (Hamilton Inlet Entrance) was in use. It is a Universal Transverse Mercator (UTM) grid for Military grid reference, Published by the Defence Mapping Agency, Hydrographic Centre Washington, D.C. It was the 3rd Edition of August, 1952 and was revised in March, 1970. Corrections were up to date. This is the largest scale chart and covers that immediate area as required by the Canada Shipping Act, Charts and Publications Regulations.

8. The IMO document Recommended Code of Navigation Practices and Procedures:

Annex A - Navigation - Part (3) states:

> "During the watch the course steered position and speed shall be checked at sufficiently frequent intervals using any available navigational aid necessary to ensure that the ship follows the planned course".

Annex B which comes under the Operational Guidance for Officers in Charge of a Navigational Watch - Navigation in Coastal Waters (21) states:

> "The largest scale chart on board, suitable for the area and corrected with the latest available information, should be used. Fixes should be taken at frequent intervals; whenever circumstances allow, fixing should be carried out by more than one method", and (22): "The officer of the watch should positively identify all relevant navigation marks".

9. The same Code also states the following:

Annex B, Echo Sounder
"(14) The echo sounder is a valuable navigational aid and should be used whenever appropriate."

The vessel's echo sounder was not in use and it is not considered normal practice to continuously run a recording paper machine. The sounding equipment was not fitted with a flashing light indicator facility. However, had the echo sounder been in use, it would have indicated that the bottom was shoaling and forewarned the bridge officers prior to grounding.

10. The chief mate is the holder of a Swedish Master Mariner Certificate issued in 1983; the certificate is valid for five years. He joined the vessel on May 30, 1984, as chief mate. He had more than one year's experience as chief mate on an associated vessel under the Swedish flag, operating between various European ports. He has been employed by the same shipping company for the past 4 years.

Remarks on the Evidence (cont'd)

11. The Master is the holder of a Swedish Master Certificate issued in 1984; the certificate is valid for five years. He had held a Master Mariner Certificate since 1974 and is also the holder of a Liberian Master Ocean Going any Gross Tonnage Certificate. He joined the vessel on March 30, 1984, and has had 4.5 years experience as Master on various ships.

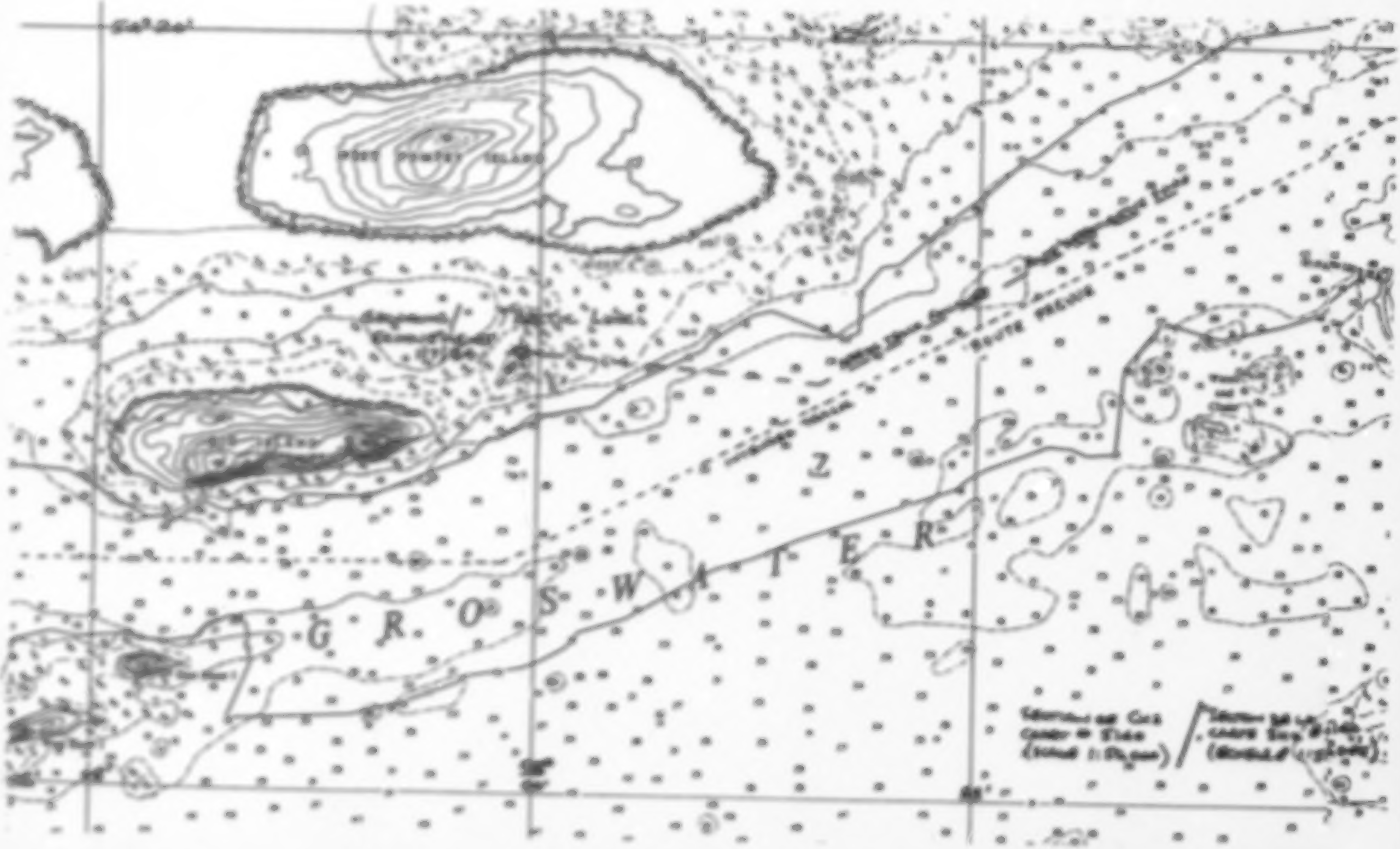
12. There were no injuries to any of the personnel due to the grounding and there was only a minor amount of pollution.

Findings

It would appear that the following factors contributed to the grounding of the "ARCTIC LINK";

- The establishment of lax navigational practices on the bridge such that there was
    - (i) failure to regularly plot the vessel's position by marking it on the chart for comparison to the intended track,
    - (ii) an alteration of course made from a position not marked on the chart, and
    - (iii) use of the radar to monitor the vessel's progress when positive land based aids were available for visual bearings.
- Absence of local knowledge in confined waters, and
- Too high a speed in unfamiliar waters.

OTTAWA, ONTARIO
AUGUST, 1984


G R O S W A T E R